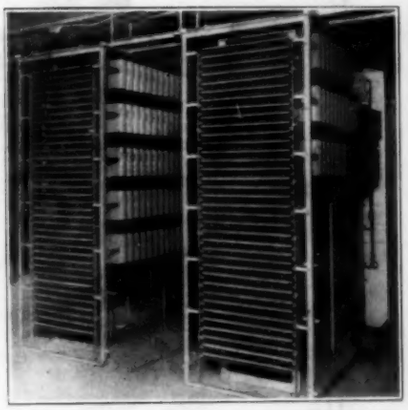
TELEPHONE ENGINEER

VOLUME XXVI JULY, 1922 Number 7

Meeting Traffic Changes



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Telephone Market Surveying

To Guard Against Costly Consequences of Bad "Hunches" Expert Outlines Factors That Allow Accurate Forecast of Telephonic Requirements

By W. C. Pickford
Division Commercial Engineer, Pacific T. and T. Co.

Planning ahead is a fundamental necessity in any business, and the telephone business is no exception.

The telephone company undertakes to make available to its customers certain intricate and costly instrumentalities, and to operate these instrumentalities in order to make it possible for any customer to converse with any other customer. This not only involves the provision of additional instrumentalities to meet the requirements of its present customers, but also necessitates anticipating as accurately as possible the number and requirements of prospective customers, in order that the instrumentalities may be provided when and where needed to meet such requirements.

If the varied and complex instrumentalities necessary to provide telephone service could be obtained by magic at a moment's notice, it would not be necessary to plan the physical plant very far ahead, although it would, of course, be necessary to do considerable planning ahead in order to have the capital available to pay for the physical plant. We are confronted, however, with the fact that a certain amount of time is required to design, manufacture and install various parts of the plant, which have to be carefully designed in order to fit in with the existing and constantly growing plant.

"Hunches" Costly

If a merchant misjudges the quantity or class of goods which he thinks should be carried in stock, it is generally a simple matter to replace the stock very quickly if it becomes exhausted, or if he finds himself overstocked he can adopt various expedients for reducing the stock and still realize at least a portion of his capital by various sales methods.

Due to the time element involved in the design, manufacture, transportation and installation of telephone plant, it will be seen that it is necessary to anticipate the need for various kinds of plant far enough ahead to permit of procuring and installing it by the time that it is required to be placed in service. It is evident, therefore, that in order to have telephone plant available when and where needed we must go about doing this in advance of the time that the instrumentalities will be needed. This is not done upon "hunch" for very obvious reasons. However, if the proper amount of plant is not placed, emergency methods must be employed to obtain more plant, which is not only uneconomical, but often results in embarrassing delays, while on the other hand, if too much plant is placed the result is equally unsatisfactory, as it means capital investment which is unproductive of revenue possibly for considerable periods of time.

It is clear, therefore, that it is essential to anticipate as accurately as possible, the demands for service in sufficient time to provide the necessary facilities to meet the requirements. We do not contend that a most carefully prepared forecast of the demands for telephone service is the final word in accuracy, on the contrary, the methods of making these forecasts have been improved in the past and we confidently expect that we will be able to improve them in the future. These forecasts can not be considered infallible, indeed they are not intended to be so, their purpose is to show reasonable approximations of the direction and probable extent of future market demands for telephone service, and as a general proposition they do this with marked reliability.

To illustrate the method of approaching the problem of forecasting the future telephone requirements of a community, let us assume that we are about to undertake a forecast for, say a city of 100,000 population. In a city of this size there will, of course, be telephone plant, consisting of real estate, buildings, switchboards and associated central office equipment including power plants, underground conduit and cable, pole lines, aerial cable, open wire, terminals, private branch exchange switchboards and telephone instruments on subscribers' premises, and many other items of telephone plant too numerous to mention. All of this plant is engaged in providing service between the subscribers in this particular city and between the subscribers in this city and subscribers in other cities and towns.

In attempting to predict the future telephone requirements of this particular city of a present population of 100,000, one of the first essential steps is to carefully analyze the existing

community in order to find out all the pertinent facts regarding the character, composition and location of the people who make up the community, and the character, size, number and location of the various business places throughout the city, and to carefully analyze the telephone requirements of the existing community.

The next important step is to predict the size and character of the community a number of years hence and to gauge as nearly as possible what the telephone requirements of such a community will probably be. Just how we go about doing this can probably be best illustrated by explaining the various steps and methods used in making such a study.

Period of Study

In determining the period in the future that should be covered by the forecast the following considerations are involved:

1. The probable rate of growth of the particular community under study, and especially changes in the distribution of population within various sections of the community, are important factors influencing the length of period that should be considered. The population of a slow growing community and its distribution can be safely estimated for a longer period in the future than in the case of a fast growing community.

2. The desirable forecast dates for purposes of determining the economical location of each new building during the reasonable life of the building.

3. The desirable forecast dates for purposes of determining the amount of building space and equipment that should be provided for certain periods of the expansion and life of the central office equipment.

4. The desirable forecast dates for purposes of installing the amount of conduit that should be installed underground to meet the cable requirements of each run with the proper balance between fixed charges of the conduits and the cost of installation or of reinforcements.

Ordinarily these considerations would lead to the adoption of a period about twenty years in the future, with several intermediate periods, generally six and twelve years, for which the forecasts of telephone demands are made.

Area to be Studied

The political boundaries of a city do not necessarily include all the territory in and around the city that is or will be closely allied socially and economically with the city. The area to be studied may, therefore, include certain suburban areas which are rural in character at the present time but which with the growth and spread of the community will gradually become a part of it. In other words, the area which will probably be served, from a telephone standpoint, as one exchange may include some sections outside of the municipal limits but which are an integral part of the community.

Estimate of Population

The demands for telephone service arise primarily from the number, character and distribution of the population living or working in the community. The preparation of population estimates necessitates the consideration of all the various factors which have contributed to the growth of the community from its earliest stages, as well as consideration of the various factors which will probably influence the future growth. A careful analysis is therefore made to determine what these factors have been and what the indications are that they will be at the future periods. Some communities depend largely upon agriculture, some upon manufacture and some upon a combination of these and other factors. Whatever the past growth of a community may have been, whatever are its unutilized natural advantages or however bright its prospects are, its probable future growth can be determined only by balancing its advantages with those of other communities of similar type. Similarly even a community with the brightest prospects will grow but slowly if for any reason the growth of the whole country is hindered. If immigration is restricted; if a series of epidemics should increase the death rate, or if the birth rate is lowered for any reason, some communities can not grow as fast as they otherwise would. Satisfactory estimates of the future population of any community, therefore, necessitate a comparison of that community's prospects with the prospects of other communities and the growth of the country as a whole, as far as this is likely to affect the growth of the community studied.

In attempting to predict the future population of a community we must give careful consideration to these features and arrive at our conclusions only after giving very careful study to the opportunities and possibilities which will tend to attract a flow of population to the area which we are studying.

Market Sections

A field survey is made of the entire community, and the community divided on a suitable map provided for the purpose into what are termed "market sections." A market section is one in which the majority of families are similar in character, from the standpoint of probable demands for telephone service. Nearly all communities have certain areas composed of families of fairly uniform type. For example, in certain sections of the city apartment houses may predominate, in other sections very large homes will predominate, other sections may be composed of homes of a middle type, while lower type houses are generally found grouped together in sections. It is also customary and helpful to segregate nationalities in market sections as accurately as conditions permit. These classifications of the community into the so-called market sections are made primarily to assist in the later steps of the study in determining the probable scope and distribution of telephone service.

Working Sections

The market sections referred to above are divided into what are designated as "working sections," or "field count sections," for convenience in carrying on the field work which is necessary in securing data for the analysis of the existing market and future telephone market requirements, and also to assist in the distribution of population and families in the later stages of the study. After the so-called working sections have been laid out the sections are numbered, and each block in each working section is numbered. The next step is to secure data for each block showing the number of existing families, places of business, vacant dwellings, vacant business places and vacant lots, together with the telephone service of each existing subscriber. A set of forms are prepared and the field man who is assigned to a working section takes an actual census of each block. He learns how many families are living in each block and determines the rental value of each place of residence. The reason we are interested in the rental values is that this enables us to determine for the families living in quarters of substantially the same rental value what proportion of them have taken the different classes of telephone service comprehended in our Exchange Rate Schedule, which usually consists of individual service, two-party service and four-party service, with gradations in the rates for the respective classes of service. For example, the field count and other data may show for a certain section that one-half of all the families living in quarters having a monthly rental value of, say $25 to $30 are telephone subscribers, and that 30% of them have individual service, 40% have two-

party service, and 30% have four-party service.

In recording places of business in each block each firm is classified according to the nature of the business, viz., retail, wholesale, manufacturing, etc., with some distinction as to whether they are large or small. A record is also made of the vacant places and vacant lots in each block, so that when it comes to distributing families and firms in the later stages of the study we will have an indication as to the available space in each section for residential and business purposes. When all of this information has been collected for each block in the study area, it is summarized, first by blocks, then by working sections, then by market sections, and then for the entire area. The data is also collected and summarized in such a way that the down-town business section and the residential section can be treated separately. In the residential section there will, of course, be found a certain amount of neighborhood business, such as drug stores, grocery stores, meat markets, etc.

Estimate of Future Market

After having secured all the data necessary for an analysis of the existing market and existing telephone requirements, together with population estimates for the community as a whole at the future periods, the next step is to set up a picture of the future market. This is done by determining, first how many families and firms there will be at the future periods corresponding to the estimated population, and second, by distributing these families and firms among the various market and working sections.

From the summaries of the existing market we know the present number of families in each market section; we know the character of the section, and in a general way its possibilities for future growth, which assists us in apportioning to each market section the number of families which it seems probable will be attracted there during the period of the study. We are aided in reaching these conclusions by studying the past and present density of the various sections, and we are guided in our distribution of the future families by the rate of growth which has occurred in the past in the various sections and their relative attractiveness and available areas for future growth. The number of families thus distributed is then segregated into various rental classes, and we are guided in this segregation by the existing segregation which was disclosed by the field count. The total future families in each section are, by this method, classified into rental types on the basis of the types of families which are a part of the existing market and are well known to our people who are acquainted with the particular community under study.

At the time of making the distribution of families in the residential section we also distribute the number of firms which it appears probable will be required to serve the particular neighborhood. This distribution of firms is made on a basis consistent with the growth in families, as it is evident that a limited number of neighborhood business places can be supported in a particular neighborhood.

This completes the picture of the future market as we expect it is likely to be at the future periods covered by the study.

Future Markets' Phone Forecast

Starting in with the market sections we consider the number of families for each of the rental classifications at the future period and estimate what proportion of these families will take telephone service, and what classes of service they are most likely to take. As stated before, the amount a person pays for rent is a very good indication of the amount of money which he will spend for other necessities, and affords a good measure of the ability of the individual to take telephone service and the class of telephone service which he will probably require. This procedure is carried out through each of the rental classifications of families, and the various classes of business are considered and estimates made of the probable telephone requirements to meet their respective needs.

After estimating the telephone requirements for the market sections, a somewhat similar procedure is followed in order to determine the probable telephone requirements for each of the working sections. The results thus obtained are before us in the form of stations of each class, that is, individual, two-party, four-party, etc. For every individual station an individual line must be provided, while for two-party stations a smaller number of lines is required, and similarly for four-party stations. The number of lines necessary to serve the estimated stations are then distributed to the various blocks throughout the entire area, and these line figures for the various periods are indicated on a map.

The forecasts thus obtained of the future telephone requirements in terms of lines and stations form the basis for further engineering studies to determine the economical arrangements in connection with:

1. The number, size and location of central offices and the boundaries of central office districts.

2. The type and size of buildings required for central office purposes.

3. The amount and type of central office equipment required.

4. The size and location of underground conduit.

5. The size, gauge and location of cables.

6. The procedure involved in the transition from the present to the future arrangement of the plant.

The results of the forecast of the future telephone requirements is, therefore, the basis for fundamental plant planning work. The plant required fifteen or twenty years hence is, of course, not placed at once, but such additions, rearrangements and extensions as are necessary to meet the demands for service from year to year are made in accordance with the indications of the study, so that the plant so constructed will harmonize and form part of a comprehensive plan for adequately and economically meeting the requirements for telephone service.

We do not wish to convey the impression that these long-period studies are so accurate that no changes are necessary. These plans are constantly under review and when necessary modified to meet changing conditions, and thus serve as a reliable guide for planning ahead, which is so essential in every business, and particularly in a large business.

BETTER INDUSTRIAL ADS

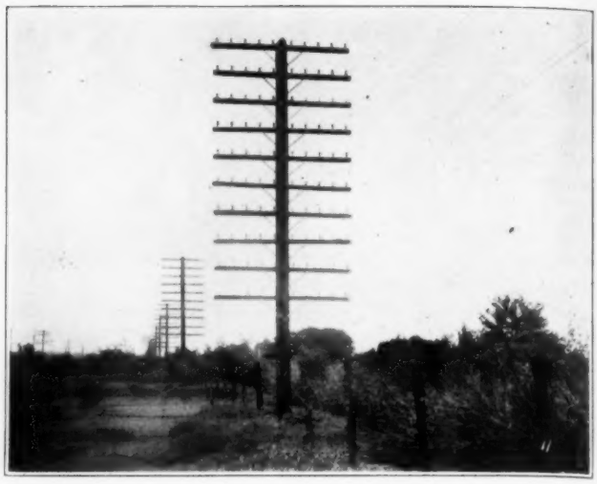
Industrial Advertisers Form New Group in Associated Advertising Clubs

Milwaukee, Wis.—A new organization which promises to greatly increase the effectiveness of industrial advertising, was formed at the recent annual convention of the Associated Advertising Clubs of the World, held here.

The new department in the advertising organization is the Industrial Advertisers' Association, in which are interested many of the country's leading industrial advertisers.

Heading the organization is Keith J. Evans of Joseph Ryerson Sons Co., of Chicago. The secretary is H. L. Baum of the Celite Products Co., 53 West Jackson Blvd., Chicago. Mr. Baum will supply complete details of the organization to those interested in industrial advertising.

Creosoted Southern Pine Poles Successfully Resist Hurricane. Note Failure of Untreated Poles.



Pressure Creosoted Pine Poles Carrying One Hundred Wires in a Long Distance Telephone Line.

Adds Life to Southern Pine

Pressure Creosoted Southern Pine Poles Good for Many Years of Thrifty Service Says Noted Expert on Pole Preservation—Tells Processes and Records

By P. R. Hicks

Secretary-Manager, Service Bureau, American Wood Preservers' Association, Chicago.

Every telephone, telegraph, power, and railway company has had more or less experience with the decay of poles and the attendant troubles and expense of replacements. The life of an *untreated* wooden pole depends upon its ability to resist decay and is influenced by many factors. Among the most important of these are the species of wood, the amount of heartwood and sapwood, the size of the pole, climate, soil and drainage conditions. *Decay can be prevented by the proper application of a good wood preservative.*

What Wood Preservation Means

The durability of *treated* poles depends upon the thoroughness of the treatment; and climate, soil, and drainage conditions have no appreciable effect on the life of a well-creosoted pole. Decay is the result of the action of low forms of plant life called fungi, the four requirements for the growth of which are moisture, air, a favorable temperature, and food. In order to prevent decay it is necessary to deprive the fungus of one or more of these requirements. It is out of the question in ordinary situations to deprive it of air and warmth, and though moisture can sometimes be eliminated to a certain extent, this can not be done when wood is exposed to the weather. *In general, therefore, the most effective method of preventing decay is to poison the food supply, or the wood structure, and upon this principle is based the successful use of wood preservatives. To be effective the preservative must penetrate the wood, and this is most effectively accomplished by the use of pressure.*

A good wood preservative must be toxic to wood-destroying fungi, it must be suitable for penetrating the wood to the required depth, it should not weaken the timber, should not evaporate or wash out of the wood easily, should be uniform in composition, and should be available in large quantities. Creosote oil, produced by the distillation of coal tar, is the preservative most widely and successfully used for the treatment of poles. In order to establish trade standards and to prevent adulteration, standard specifications for coal-tar creosote have been adopted. The specifications of the American Wood-Preservers' Assn., which are similar to those of the American Railway Engineering Assn., and others, are considered the standard, and their adoption was the result of a study extending over a period of several years.

The use of coal-tar creosote for the preservation of wood against decay dates back several centuries, but its extended use in Europe practically started in 1838, when the pressure process was first introduced. Modern pressure treatments in the United States may be considered as having begun in the late seventies or early eighties, when plants were erected for the treatment of bridge timbers and piling for the Louisville and Nashville and the New Orleans and North Eastern railways. It is interesting to note that these first real attempts in timber preservation were made not on account of the scarcity of timber but because of the high cost of replacing it. Creosoted timber was the most economical material for a permanent structure, and timber pressure treated with creosote about 40 years ago is still in service.

Pine Poles Pressure Creosoted

To prevent decay in the tops as well as in the butts, southern pine poles are creosoted their entire length by one of the standard pressure processes. A difference of opinion regarding the use of any particular pressure process for the treatment of poles may exist among engineers well informed on the treatment of wood, but a pole which has all sapwood thoroughly penetrated with creosote by any of them will give long service.

These standard pressure processes differ in details, but the general principle is the same in all cases. The essential feature is the use of pressure to force the preservative into the wood. By this means the penetration of the preservative is subject to control, so that the amount of the pre-

servative and the penetration may be varied to suit the different requirements.

Plant Equipment

A wood preserving plant for the pressure treatment of poles consists principally of one or more treating cylinders or retorts 6 or 7 feet in diameter, about 120 to 150 feet long, and capable of withstanding a working pressure of 125 to 200 pounds per square inch. Inside the cylinder is a track for tram cars which carry the poles to be treated. These cars, loaded with untreated poles, are handled in trains and are run into the retort by small locomotives. The cylinder door is then closed, and after treatment the cars with the treated poles are removed and the material loaded for shipment. The treating cylinder is provided with heating coils to heat the preservative, which penetrates the wood more readily when hot.

In addition to the treating cylinders, there are storage and measuring tanks for the creosote, the necessary pressure and vacuum pumps, and facilities for steaming the timber when necessary.

Pressure Treatments

Pressure treatments are grouped into two classes: (1) Full-cell process, in which the intercellular spaces of the wood are filled as completely as possible with the preservative; and (2) Empty-cell process, in which as thorough and deep a penetration as possible is secured by treating to refusal, but with a final retention of a minimum quantity of the preservative.

Full-Cell Process

In the full-cell, or Bethell, process, as it is frequently called, the seasoned poles are placed in the retort, a vacuum drawn, and without first breaking the vacuum the cylinder is completely filled with the preservative fluid. The vacuum not only accelerates the entrance of the creosote into the retort but also makes it possible to force it into the timber more quickly and with less pressure than is the case when the preservative must displace or compress the air in the wood. After the retort is filled additional creosote is forced into the cylinder by means of pressure pumps, the pressure being gradually raised to and maintained at 125 to 175 pounds per square inch at a temperature of about 180 to 200° F. until the required amount has been forced into the wood. The pressure is then released, the preservative drawn from the cylinder and, as a rule, another vacuum drawn. The object of this final vacuum is to remove the surplus creosote from the surface of the poles and hasten the dripping so that the treated wood can be removed from the cylinder as soon as possible. The final vacuum also makes the wood dryer on the surface and cleaner to handle. A final vacuum was not used in the original full-cell process, but was adopted later, after the development of the empty-cell process. For the treatment of poles by the full-cell process about 10 to 15 pounds of creosote oil per cubic foot of wood treated is considered standard practice.

Empty-Cell Process

The Rueping and the Lowry are the standard empty-cell processes. In the Rueping process a vacuum is not drawn preliminary to admitting the oil, but, on the contrary, air is pumped into the cylinder, and thus into the seasoned poles, under considerable pressure. Then, while this air pressure is maintained, creosote oil is pumped into the bottom of the cylinder. As the oil enters, the air is gradually released from the cylinder, but without allowing the pressure to drop. In this way the cylinder is filled with oil, but a considerable quantity of air is entrapped in the wood.

The Poles Are Loaded on Cars, Run Into the Treating Cylinder, and Treated by the Pressure Process.

More oil is now pumped in and the pressure is increased. This compresses the air within the wood and forces oil in on top of it. When the poles have been treated to refusal the pressure is released and the oil drained from the cylinder. A quick final vacuum is now drawn. This great reduction in pressure allows the air entrapped in the wood to expand and force some of the oil out of the wood.

The Lowry process, which is somewhat similar to the Rueping process, depends upon the air naturally existing in the wood with the help of a final vacuum to force out the excess oil after the pressure period.

For the treatment of poles by the empty-cell process the creosote is injected under pressure to refusal, or at least until a deep and uniform penetration is obtained, and then a portion of the free oil in the wood cells is removed, leaving a final retention of from 8 to 10 pounds of oil per cubic foot.

The general descriptions above refer to the treatment of seasoned poles only. While it is possible to treat green timber, it seems to be the consensus that a more effective distribution of the preservative is obtained by the treatment of air-seasoned material. In many instances telephone companies can not anticipate their needs far enough in advance to obtain air-seasoned stock, and it is then necessary to treat green material, which is usually prepared for treatment by steaming for the proper period, followed by an initial vacuum.

The American Wood-Preservers' Association has no standard specifications for the pressure treatment of poles, but a committee has been instructed to develop such specifications for presentation at the next annual meeting.

Durability

Creosoted pine poles have been extensively used in Europe for many years. Foreign investigators have stated that poles treated with creosote by the full-cell or the empty-cell process were in service and in good condition after 20 to 40 years' service, but it has been almost impossible to obtain what might be considered authentic records of service. The same condition is true in the United States, where pressure creosoted pine poles have been more or less used for about 35 years.

For information on the expected life of this class of material for telephone poles it may be of interest to note the experiences of some of the railroads with the use of creosoted piling for bridges and trestles. The Santa Fe, the Louisville and Nashville, and the Southern Pacific were pioneers in the use of creosoted piling, and their structures built over the water and on land were in good condition when demolished for new construction after 25 to 30 years' service. In an address before the Western Society of Engineers in Chicago on January 24, 1922, A. F. Robinson, Bridge Engineer of the Santa Fe system, stated that the creosoted pine piling was in good condition after 16 to 20 years' service, and was probably good for 20 years more. The conditions under which creosoted wood must serve when used for piling are undoubtedly more severe than when used for pole purposes. Piling is cut off after driving, and decay had started in the tops of some pieces which were

not properly protected after the untreated wood had been exposed. This condition can be guarded against in the use of poles by framing before treatment.

Creosoted pine poles have given excellent service after 25 years' use in the West Indies, and many electric and telephone companies in various parts of the United States have used this class of poles with good results for 15 to 25 years or more.

The American Telephone and Telegraph Co. probably uses larger quantities of creosoted pine poles than any other company in the United States. A brief summary of the latest available results of the inspection of the pressure creosoted pine poles in the Washington-Norfolk and the Montgomery-New Orleans line of this company follows. A detailed account of these inspections is published in the Transactions of the American Institute of Electrical Engineers for the year 1915.

Pressure Creosoted Pine Poles in the Washington-Norfolk Line of the American Telephone and Telegraph Company

Absorption of creosote—About 12 pounds per cubic foot.
Installed 1897—Inspected in December, 1914.
9,555 poles sawed square.
13 poles sawed octagonal.
407 natural round poles.

9,975 total number of creosoted poles.

In December, 1914, after about 17 years' service, 1,696 poles were carefully inspected in groups of 89 to 312 chosen at different points throughout the entire line with the following results:

	Number	Per cent
Poles removed on account of decay or in a condition which warrants early removal	46	2.7
Poles removed for highway or railroad construction, rerouting of line, etc	43	2.5
Poles removed for experimental purposes	5	0.3
Poles removed for unknown reasons	8	0.5
Poles in line showing some decay but still serviceable	127	7.5
Poles sound and still in service	1,467*	86.5*
Total	1,696	100.0

*Eliminating 56 poles removed for causes other than decay, 97.2 per cent were in service after 17 years, and 89.4 per cent showed no signs of decay. In 87 of the 173 poles showing signs of decay the source of entrance of decay was determined. In 39 poles, or 45 per cent, the decay started in checks; in 36, or 41 per cent decay gained entrance in the tops, which were cut off after treatment, thus exposing untreated wood; and in the remaining 12 poles, or 14 per cent, the decay started in shakes, bruises, knots, and auger and insect holes.

Pressure Creosoted Pine Poles in the Montgomery-New Orleans Line of the American Telephone and Telegraph Company

Absorption of creosote—About 12 pounds per cubic foot.
Installed 1899—Inspected early in 1915.
7,644 natural round creosoted poles.

In January, February, and March, 1915, after about 16 years' service, 1,598 poles were carefully inspected in groups of 150 to 228, chosen at different points throughout the entire line, with the following results:

	Number	Per cent
Poles removed on account of decay or in a condition which warrants early removal	84	5.2
Poles removed for highway or railway construction, rerouting of line, etc	15	0.9
Poles removed on account of damage by storm	8	0.5
Poles removed on account of damage by fire	7	0.5
Poles removed for experimental purposes	1	0.1
Poles in line showing some decay but still serviceable	434	27.2
Poles sound and still in service	1,049*	65.5*
Total	1,598	100.0

*Eliminating the 31 poles removed for causes other than decay, 94.8 per cent were in service after about 16 years. Of these 67 per cent showed no signs of decay. In 223 of the 518 poles showing signs of decay the source of entrance of decay was determined. In 143 poles, or 64 per cent, the decay started in checks; in 60, or 27 per cent, it started in shakes; and in the remaining 20 poles, or 9 per cent, it was caused by axe cuts, knots, bruises, etc.

A summary of the above figures shows that only 4 per cent have been removed on account of decay, 17.5 per cent show some signs of decay but are still serviceable, and 78.5 per cent are evidently as sound as when originally placed 15½ to 17 years before. The cause of the decay of some poles is shown in the footnotes to the tables.

In the inspection of these poles the tops and butts were carefully examined, and if only a trace of decay was found the pole was classified as "partly decayed."

In 1897 over 3,000 creosoted pine poles were placed in the Charleston-Montgomery Line, and in 1899 about 6,000 were placed in the Birmingham lines of the American Telephone and Telegraph Co. In discussing these lines at the 1921 convention of the American Wood-Preservers' Assn., Mr. R. F. Hosford, of the A. T. and T. Co., stated that records, the details of which were not available, showed that the behavior of the poles was equally as good as that of the poles in the Washington-Norfolk and the Montgomery-New Orleans lines. The poles in these lines were seasoned by steaming in the treating cylinder, then treated with about 12 pounds of creosote per cubic foot by the full-cell process.

Strength

Southern pine and Douglas fir are the strongest and most widely used of the commercially important species in the United States, and for poles and various types of building construction engineers use higher working stresses for these than for other species of wood. The use of well-creosoted southern pine poles insures long service, and the original strength is maintained since the treatment prevents weakening by decay.

Fire Hazard

Tests to determine the relative fire hazard of creosoted and untreated wood have been made at various times during the past few years. The results of these tests, which showed that creosoted timber is less damaged by fire than untreated wood, have since been confirmed by the experience of many telephone and power companies using creosoted poles, and in several instances by railway companies using large quantities of treated and untreated posts along their right of way.

Prevents Termite Attack

Termites or "white ants," as they are commonly called, do considerable damage to untreated poles throughout the United States, especially in the South. In discussing methods of

preventing termite attack Dr. T. E. Snyder of the U. S. Bureau of Entomology states, in Farmers' Bulletin 1037, "The most permanent known practical method is to impregnate the wood under pressure with coal-tar creosote," and the efficacy of this method is borne out by the experience of various companies using pressure-creosoted pine poles.

Increased Use of Creosoted Pine

Statistics on the total number of poles treated annually at the regular pressure or open-tank treating plants have been available for about 13 years, but the number treated by the pressure process had not been determined until 1920. In that year there were creosoted 585,781 poles, of which 164,425, or about 28 per cent, were pressure creosoted pine and the remainder were chiefly cedar, butt treated by the open-tank process. In 1921, 259,738, or about 42 per cent of the 622,685 poles treated, were pressure-creosoted pine poles, an increase of about 60 per cent over the number treated during the previous year.

Summary

1. Southern pine poles are pressure-treated by the full-cell and by the empty-cell processes. To be effective the creosote must penetrate the wood, and if the sapwood is thoroughly impregnated long service can be expected.

2. About 10 to 15 pounds of creosote per cubic foot is considered standard for poles treated by the full-cell process, and 8 to 10 pounds per cubic foot for the empty-cell process.

3. After 16 to 17 years' service in the Washington-Norfolk and the Montgomery-New Orleans lines of the American Telephone and Telegraph Co., 4 per cent of the creosoted poles were removed on account of decay, 17½ per cent showed some signs of decay but were still serviceable, and 78½ per cent were sound. "Checks" and "shakes" were the chief causes for the entrance of decay, although cutting off the tops after treatment, thus exposing untreated wood, was the reason for the decay of many poles.

4. The experience of many telephone, power, and railway companies with creosoted posts and poles has been that creosoted poles are considerably less damaged by fire than untreated poles.

5. In 1921 the number of pine poles pressure-creosoted was nearly 60 per cent greater than during the previous year, and represented about 42 per cent of the total number of poles of all species treated at the various pressure and open-tank plants.

6. Pressure-creosoted pine poles are not subject to attack by termites or "white ants."

7. Coal-tar creosote conforming to the standards of the American Wood Preservers' Association, the American Railway Engineering Association, and others, is successfully used for the treatment of southern pine poles.

8. Creosoted pine poles are in use not only throughout the South, but in more northern states as well, among them, Kansas, Nebraska, Iowa, Illinois, Wisconsin, Michigan, Indiana, Ohio, New York, and Pennsylvania, and in the province of Ontario, Canada.

Western Electric's Workers Listened In as Coast Talked to Coast

CROSS CONTINENT CHAT

27,000 Western Electric Workers Listen In on Addresses from Both Coasts.

Hawthorne, Ill. — A Pageant of Progress where the transcontinental telephone, the most highly perfected radio apparatus, airplane and motion photography all were accepted more or less as a matter of course was staged for the 27,000 employees of the Hawthorne plant of the Western Electric Co., June 14th, by Phil Thomson, advertising manager of the organization.

From his office in New York, President Du Bois of the W. E. talked to his employees. F. B. Jewett, Vice President in charge of manufacturing and engineering, also talked from New York. President H. B. Thayer of the Bell, an ex-team mate of many of the Hawthorne hustlers also addressed the throng in the vast concourse of the Hawthorne plant, from the Manhattan end of the wire.

At San Francisco, 2,000 miles away, J. C. Nowell, Vice President of the Pacific Telephone and Telegraph Co., talked to Hawthorne's crowd, employing the remarkable equipment his listeners had made. The speakers were introduced by Vice President H. F. Albright, General Superintendent of the Hawthorne plant. Utilized in the interesting performance was some of the amplifying apparatus developed by the Western Electric technical staff for use in radio telephone work particularly.

As the distinct and distantly audible speeches came from the specially constructed receivers with tone directing horns, an airplane swung low above the crowd, taking photographs of the assembly, and a motion picture camera ground away a film record of the event.

A notable audience of men prominent in the industrial life of Chicago witnessed the demonstration.

Especially impressive was the smoothness with which the performance was conducted. Stars of the W. E. engineering staff had the apparatus tuned to such concert pitch that a paper clip falling on President DuBois' desk would have sounded like a runaway team on a covered bridge.

The equipment was the same as that used by President Harding on several occasions.

Avoiding Conflict of Wires

Authority Suggests Methods of Co-ordination in Bettering Relations Between Telephone and Power Lines—Joint Pole Line Solution in Some Cases

By W. H. Curran

Plant Engineer, Indiana Bell Telephone Co.

The subject of relations between supply and signal lines at this time is a very active one; in fact development has been so rapid as to cause considerable concern to both utilities. It is of such vital importance to the successful operation of both signal and supply lines, that the plant of both utilities be properly and economically constructed and maintained, that the representatives of these services who are charged with the responsibility of plant design and construction, must work in the most friendly spirit of co-operation.

There are many features in the construction of a telephone property that must be given careful consideration, because of the highly sensitive character of telephone circuits. When the difficulties of this construction are increased through outside forces, the problem is made still more difficult, and unless overcome, the quality of service is lowered, if not entirely destroyed. During the period of our development, there has been an equally important public service utility expanding and bending every effort to keep up with the industrial and commercial growth of the country, and that is the electric power industry. It is the development of this industry that we are most concerned in, as it is becoming a serious factor in the operation of our lines in those localities where the voltages are of such a character as to cause interference with the communication circuits.

Until a comparatively few years ago, however, the problems of interference to the telephone plant from power circuits was confined to the cities, with here and there a high voltage transmission line. For many years the telephone industry has been developed in the rural districts and between cities, so that now there are few localities that are not served by communication circuits.

Power Development in Second Stage

Now the power development has reached what might be termed its second stage, in which is the extensive development of the high voltage transmission line, the linking together of large power plants, cities and towns, and the furnishing of power to the rural districts. This expansion has been very rapid, and undoubtedly is still in its infancy, to what the development will be in a few years. We can well expect the expansion of the electric power industry to be as extensive as that of the communication company. In fact the construction of power lines has been so rapid and heavy in some localities that now our lines are paralleled, overbuilt and crossed so generally, as to seriously interfere with the rendering of good telephone service. In the first place telephone circuits are much more sensitive than power lines, and for this reason can be seriously affected by close proximity with power circuits. There is no possibility of currents used on telephone circuits affecting transmission lines. For this reason, therefore, the two classes of circuits cannot be considered on the same basis.

Up to a certain point, it has been possible to reduce inductive interference in the telephone circuits, through various methods, but the development of high voltage circuits has been so rapid that it is now no longer possible to confine all the corrective measures in our own lines, as has been the practice in the past, and co-ordinated methods must be applied. Power induction on telephone lines may be reduced by co-ordinated transpositions in both lines, through design of power apparatus, and by balancing the phase wires. These measures may produce somewhat satisfactory results, but in long parallels there is usually a certain amount of noise which results in impairment to service, and at times of abnormal disturbances, which may be caused by broken insulators, line breaks, switching, etc., transpositions in either or both the power or telephone circuits will avoid failure in the telephone circuits. As stated before, there are cases where certain measures can be applied, where interference may be reduced, but there will be instances where complete separation of the lines is the only practicable remedy.

It is generally acknowledged, I believe, that the conditions mentioned exist, and our problem is therefore to reduce the number of cases of interference to a minimum and to avoid the introduction of new like conditions; and to work out a plan whereby the public may obtain the maximum benefit of these services at the minimum cost, without interference one with another. To start with, there are three considerations, first—the telephone companies have generally developed the present productive territory, and are now occupying highways outside cities, for rural service and inter-city circuits; second,—the power industry is now developing rural communities and are constructing high voltage transmission lines between power plants and cities; third,—both utilities will make extensions into new territory as it develops.

Solution Lies in Co-operation

There is only one satisfactory solution to the problem, and that is through the development of close relationship between the two industries. There should not be any necessity for resorting to legal actions on the part of either utility, for the facts are that the services of both are for the benefit of the public, and it is entitled to continuous and uninterrupted service from both. It is therefore strictly the responsibility of each utility to so construct and maintain its property in such a manner as not to interfere in any manner with the operation of one with the other. Take the first condition which was mentioned a moment ago, that of the telephone circuits now occupying routes that the power circuits are to be extended on,—the telephone company has a right of priority to the location it is occupying, and this must be given consideration by any incoming utility. The telephone company must maintain service of good quality, and the power company has no equitable right to do anything that would cause an impairment to the telephone service. It is clearly

the responsibility of the power company to so arrange its circuits as not to cause any interference or hazards to the existing property. If co-ordinated methods are required to insure satisfactory service, then it is the duty of the power company to arrange for these measures, and the duty of the telephone company to work, co-operate and arrange its plant to meet the new conditions.

In the event that alternate routes are available, it is felt that the power circuits should be located on such a route, thus avoiding expensive changes in the property of the company whose plant is affected by the new extension. This is particularly true in the case of long parallels of high voltage transmission lines.

Assuming the case of a route occupied by a power lead, and an extension of telephone circuits is contemplated, the same conditions should apply; the telephone line should be located away from the parallel if practicable, or if not, the telephone company should arrange for the necessary changes in the power circuits.

Another case comes to mind; where two telephone lines occupy both sides of a highway, and a power line extension is planned, it seems to me that the communication circuits should be consolidated on one lead on one side of the highway and the opposite side cleared for the power circuits. These same conditions to apply in the event both sides of the highway were occupied by power circuits; one side should be cleared for the telephone circuits.

In the case of extensions into new territory, the utilities should get together and determine what is required, and lay out their plans to avoid conflicts or interferences between properties before starting work.

Forecasting Corrective Measures

The time to determine what is required in each case is before any expenditures are made, and in order that this may be done, cultivate the acquaintance of the power people, learn something of their problems, and be frank and honest in presenting your own situation. It is only through this contact that we will be able to gain the confidence of the power utilities, and convince them of our sincerity in this vital matter. We must not make unreasonable demands on them, neither must we incur unwarranted expense in making changes in our lines, but we must realize that both companies are serving the public and that it is the service we are rendering the public that must be insured, and no conditions can be permitted to be built up in either plant that will impair this service in any manner.

So far this paper has pertained principally to those power circuits of a high voltage nature, usually considered by telephone people as anything over 5,000 volts. The reason for this limitation is obvious to the telephone people, but these reasons must be clearly explained to the power people, to avoid the possibilities of misunderstandings. Whereas it is the desire to avoid conflicts with the power circuits of high voltage, there are great possibilities of savings to the companies, on using jointly constructed pole lines, where conditions are such that this can be accomplished. This is a subject that we are having to meet more and more every year, and now that the power field is expanding to a greater extent than ever before, the immediate needs for proper construction and maintenance of both telephone and power plants is more readily realized.

The necessity for proper maintenance to the rendering of high grade telephone service is realized, and we know what it means to keep our lines free from tree grounds, broken insulators, slack, loose guys, etc., the necessity for nearly perfect balance in our lines, and that these things are essential whether we are in close proximity to power lines or not, so that when we become involved in parallels with power circuits, our problems become still greater, and still more importance must be attached to our maintenance work.

In the first place it is agreed, I believe, that the telephone plant must be kept free from conflict or interference from all high tension lines. This should be done by complete separation, by means of different right-of-way, alternate highway routes, etc., or at the least, by highway separation, and in this case special co-ordinated transposition schemes applied to both lines; however these cases are the exception rather than the rule, and for the most part are capable of solution to the satisfaction of both interests.

Economy in Joint Construction

Eliminating those cases mentioned, there are in all locations overhead plant of both systems that parallel and serve the same areas where a great economy may be effected by consolidating the services on one pole line, and it is to this end that we should work.

As a rule joint construction between telephone and supply circuits may be safely used when the supply circuits do not carry voltage or current in excess of:

(a) Constant potential, alternating current, not exceeding 5,000 volts between wires (or 2,900 volts normally to ground).

(b) Constant potential direct current, not exceeding 750 volts, constant current, series metallic line current not exceeding 7.5 amperes.

(c) When systems using lamps operating at currents in excess of 7.5 amperes, but equipped with compensators or transformers so that the line current does not exceed 7.5 amperes.

(d) Constant potential, direct current, trolley contact wire and feeder not exceeding 750 volts to ground.

The above conditions apply to all classes of telephone plant, with the exception of open wire toll circuits. It is highly desirable that all toll lines be kept free from parallel or overbuilds with supply circuits of any description, and every effort should be made to accomplish this. There are cases where it will be necessary to make a joint lead with toll and supply circuits, but as a rule these can be avoided. Telephone toll lines may be likened to the transmission supply lines in that they are the trunk feeders of the telephone system, and being of a highly important character, all possibilities of interruptions are guarded against, and even greater precautions are necessary to prevent interference than are required in the transmission line.

In every case of extensions into new territory, the telephone company should advise with the power representatives, and determine in advance what work is to be done, and the power company should reciprocate in a like manner. The same conditions apply in rebuilding or reconstruction work, and if both interests will advise with each other, there will result a closer relation with the desired improved plant conditions and savings to both.

Plan Extension of Freeport, Fla., System

Freeport, Fla.—James Vaughan, owner of several telephone properties in west Florida, recently visited his Freeport property and announced that extension of the local lines would be made, probably to Santa Rosa and Point Washington.

Platte Valley Co. Issues $85,000 New Stock

Scottsbluff, Neb.—State commission authorizes the Platte Valley Telephone Co. to issue $85,000 common stock to be used for taking over the property of the Wehn Telephone Co., paying off its own indebtedness, and making betterments.

Electron Tube Simplified

Phenomenon Noted by Edison During Carbon Lamp Experiments Genesis of Versatile Device Having Important Function in Radio and Wire Telephony

By R. V. Achatz

Recent development of the radio telephone which has created almost over night a new industry, and which has aroused a public interest greater than any other recent invention, was made possible by the invention of the electron tube or audion as it was named by Dr. Lee DeForrest, to whom is due the credit for the invention which made its application possible.

This versatile device enters into almost every department of the process of transmitting intelligence and entertainment by radio telephone and it has found important applications in the wire telephone art.

In the radio telephone, used with some auxiliary devices it produces the high frequency oscillations which are necessary for radio transmission. It is used to modulate the oscillations so that they represent faithfully the variation of the voice of the speaker at the sending station. It is used at the receiving station to separate the voice wave from the high frequency "carrier." If the current is still too weak to affect the telephone receiver another tube is used to amplify the wave until it will produce audible sound. If it is desired to make the sound audible to an entire room additional tubes will provide the necessary amplification. It is finding other applications outside the communication field and important developments along other lines may be expected. Few devices in recent years have been studied by scientists and investigators as intensively and thoroughly as the electron tube. Within the last two or three years several books have appeared which are devoted exclusively to explanations of its principles and applications. It is impossible in a short article to give more than a general description of its construction and operation from a purely qualitative standpoint.

Edison Discovered Fundamental Principle

When Thomas A. Edison was engaged in his development work on the carbon filament electric lamp he discovered an effect which he could not explain satisfactorily. As the lamp grew older a black deposit formed on the bulb and it was found that the carbon filament gradually decreased in diameter. The vacuum in the lamp was as perfect as it was possible to make it and yet there was a transfer of the carbon from the filament to the lamp bulb.

When the inventor started to investigate this he proceeded by placing a plate of metal inside the bulb and connected the plate to a lead wire which was sealed into the glass of the bulb. In the process of his experiments he discovered that a galvanometer connected from the positive terminal of the lamp to the lead from the plate (Fig. 1a) indicated a flow of current between the plate and the filament. If the galvanometer terminal was transferred from the positive terminal to the negative terminal (Fig. 1b) no current flow was indicated.

These results seemed to indicate the peculiar circumstance that a current of electricity could flow through a vacuum under certain conditions and the particular condition that was necessary was that the potential of the plate must be positive with respect to the filament.

If the plate was negative no current would flow.

No explanation of this curious result was made for several years and it became known as the Edison effect. It was an interesting scientific novelty but one without practical importance.

Like many other novelties of this kind its action was finally explained and applications of far reaching importance have been found.

A New Idea—Electron Theory

In order to give even a simple explanation of the action of the electron tube it is necessary to digress for a moment to give attention to some changes in the ideas of matter and electricity that have occurred in the last two decades. Up to the end of the last century, scientists for nearly a hundred years had been accustomed to explain chemical and physical facts on the basis of the atomic theory.

This theory taught that it was possible to subdivide matter into smaller and smaller divisions until an extremely small division, the molecule, was reached after which no further division was possible. If an attempt was made to subdivide a molecule the result was that the original kind of

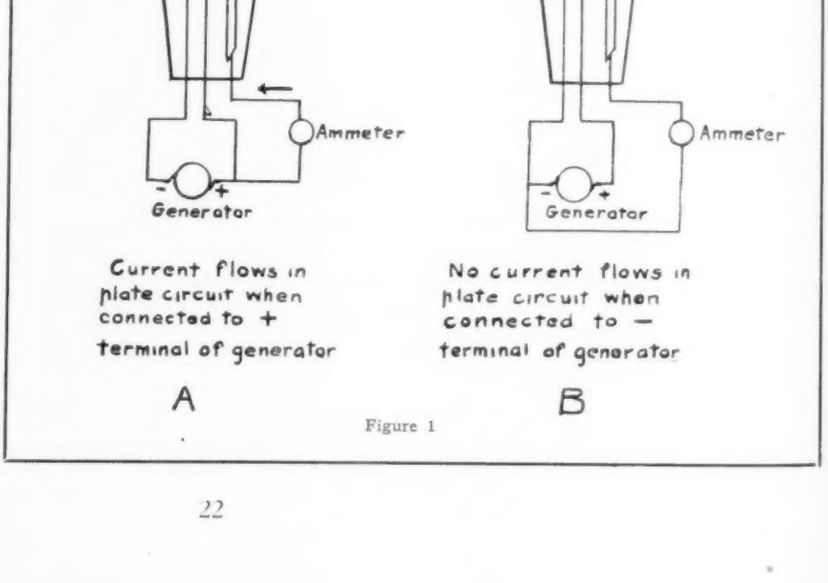


Figure 1

matter disappeared and instead the elements from which it was made appeared. The breaking up of water into hydrogen and oxygen by electrolysis is an example of the decomposition of a substance into its elements. Some eighty or ninety of these elements are known at the present time. When the molecule of matter is broken up into its elements the small masses of the elements were known as atoms. It was taught that the atom was the ultimate division of matter and that it was impossible to subdivide the atom.

A series of investigations by J. J. Thompson, H. A. Lorentz, Richardson and others has directed recent scientific thought into the belief that the atom is not the smallest division of matter and that each atom is made up of some kind of a nucleus and small particles of electricity called electrons. The number of electrons may run from one to several thousand in each atom depending upon the element to which the particular atom belongs. The electron has the characteristics of a small negative charge of electricity and electrons may exist either as "free electrons" which are not associated with any atom and as "bound electrons" or those which are associated with other electrons and the neucleus to form an atom. If a group of free electrons accumulate in a given area, the area has a negative charge while an atom which has less than its required number of electrons has the characteristic of a positive charge and so a positively charged body is one where some of the atoms do not have the required number of electrons.

Free electrons exist in nature as in the case of radio-active materials like radium or they may be produced by splitting some of the electrons off from the atoms and throwing them into the surrounding space. Some of the means by which electrons may be split off from their atoms are by chemical action and by the application of heat. The application of heat increases the agitation of molecules of a material and collisions inevitably occur. These collisions may occur with sufficient force to break loose one or more electrons from their atoms. The electrons which have been split off from the atoms are subject to the ordinary laws of electricity that like charges repel each other and unlike charges attract and they ordinarily re-combine with atoms which have lost some of their electrons. If, however, the substance is heated to incandescence the electrons may be given such a momentum that they will pass through the surface of the material into the space around it as in the case of Edison's incandescent filament.

Edison Effect Explained by Electron Theory

The electron theory offers rather a simple explanation of the Edison effect.

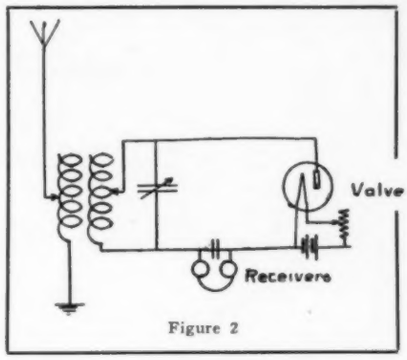


Figure 2

When the filament is heated to incandescence electrons are thrown off into the space surrounding the filament. Ordinarily this creates a deficiency of electrons in the filament which is the same as a positive charge and the electrons again return to the filament.

When the plate was inserted into the bulb and the bulb sealed and exhausted a different situation could be made to exist.

If a battery is connected into the plate circuit as shown in Fig. 1 (a) with the positive terminal of the battery connected to the plate and the negative terminal of the battery connected to one terminal of the filament a positive charge is placed on the plate. This positive charge attracts the electrons away from the filament and a current flows in the plate circuit as would be indicated by a small ammeter placed in series with the plate battery. If the battery were reversed as in Fig. 1 (b) the plate would become negative and the electrons would be repelled instead of attracted. In this case no current would flow in the plate circuit.

In this way, there might be produced an actual flow of electricity through a vacuum from the filament to the plate when the plate is positive but no flow would be possible when the plate is negative. If an alternating current were applied to the plate, current would flow only during the portion of the cycle when the plate is positive. The tube would thus act as a valve to the flow of alternating current and would allow a flow of current in one direction only.

Fleming Applies Valve Action to Radio Detection

In the transmission of radio signals it is necessary to make use of current oscillations which occur at very high frequencies as compared to ordinary power and telephone circuits. The range of frequencies is from about 10,000 to two or three million cycles per second which is well above the range of audibility. For this reason it is necessary to use some kind of a detector for the signals that will cause a greater effect when current flows in one direction through the telephone receivers than when it flows in the opposite direction. One means of doing this is to cut off the current entirely in one direction. One simple means of doing this is the crystal detector which makes use of the property of certain crystals to carry current in one direction better than in the opposite direction. Prof. J. A. Fleming in England applied the two element tube similar to Edison's device in a way that took advantage of the valve action.

The method of use is illustrated in Fig. 2. During the portion of the time that the impulses of current in the circuit made the plate positive current would flow through the receivers. When the plate was negative no current flowed and so the receiver diaphragms would respond to the positive impulses only. As these came in audible frequency groups, an audible signal was produced.

The Fleming valve never came into extensive use, due partly to the fact that it was very little superior to a good crystal in sensitiveness and required an additional battery for operation. The invention of an improved device by DeForrest followed closely and the Fleming valve had little commercial importance.

DeForrest Improved Electron Tube

About the same time as Dr. Fleming was working on his valve detector, Lee DeForrest was experimenting along the same lines in the United States. The device invented by DeForrest made use of the flow of electrons to a positively charged plate but differed radically in the manner of its action. In the DeForrest tube, which he named the "Audion," the plate is always maintained at a positive potential by a separate battery and the electron stream flows continuously while the tube is in operation. A third element in the form of a gridiron or network of wires is introduced between the filament and the plate and serves as a control element.

If a positive voltage is applied between the grid and the filament making the grid positive as in Fig. 3 (a), the number of electrons transferred to the plate is greater, due to the addi-

Showing Tele-Disc installed with Miller Lock

Tele-Disc Publicity

is a new advertising media in that it sing that the right place at the right time as i of the st phone equipment.

Tele-Disc Publicity

is permanent because it is installe intained phone by the Telephone Companies.

The Tele-Disc Plan

deals with the Telephone Companie them a rental for the space and a fair price trouble f and maintaining them.

Stability the Factor

that assures the success of TELE-DI LICITY when one sees the celluloid disc ba ith reinf and firmly locked in place by the ent lock This adds a finished look to the tele makes ing disc a permanent part of the tele

The Telephone Companies

equip their phones with this device t GIVES T ENUE without a corresponding in Whatev for rental of this space is turning a profit. of fact the annual rental of THIR N cents will pay a fair rate of interest on the t cost of

Something for Nothing

here is a chance for more revenue vestment solutely the most SUBSTANTIAL NG FOR that the telephone people have ever

Tele-Disc bli

OF AMER

Write, Wire or
Wm. Clarke Jewell, General ector Sale
Executive Offices: Ridge Bu City, Mo

The Accompanying Diagram

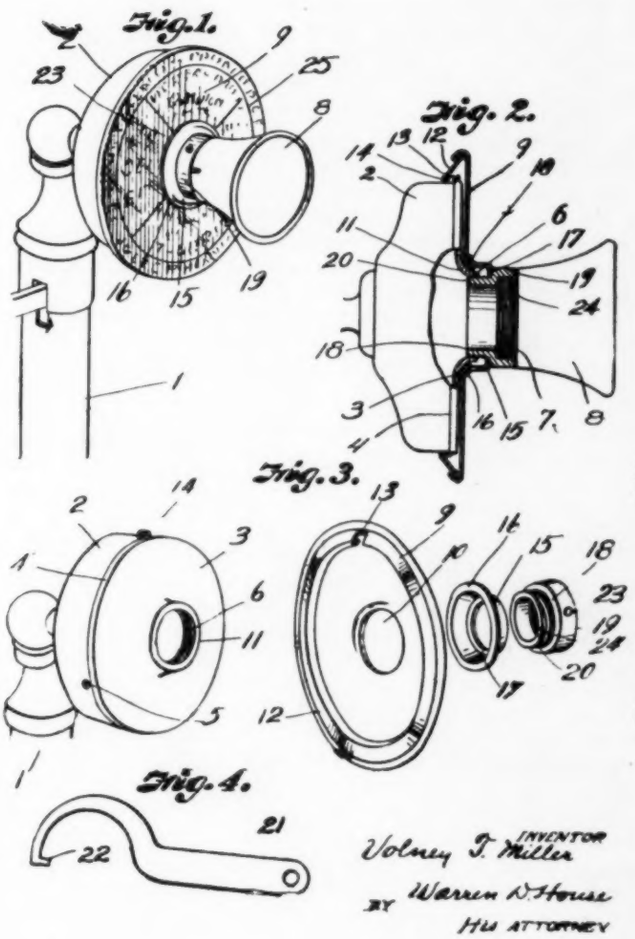
illustrates the disc, locking device and method of installation. The disc 9 is made of No. 26 gauge metal reinforced by a corrugated metal ring on its back side. The printed advertising disc is placed in position and covered by transparent celluloid and the parts crimped in place, making a sanitary, permanent and attractive advertising device.

The Binding Ring

16 is put over the disc and the lock 19 screwed into the face of the transmitter. A special wrench is used to screw the lock down tight on the face of the binding ring. This wrench is shown as 22, and locks the disc in place so that it cannot be removed except with the use of the special wrench.

The Disc Fits

any and all makes of telephone transmitters, but each different kind or make require a different thread on the locking device and for this reason these are made in different sizes of threads so as to take care of all makes of equipment.



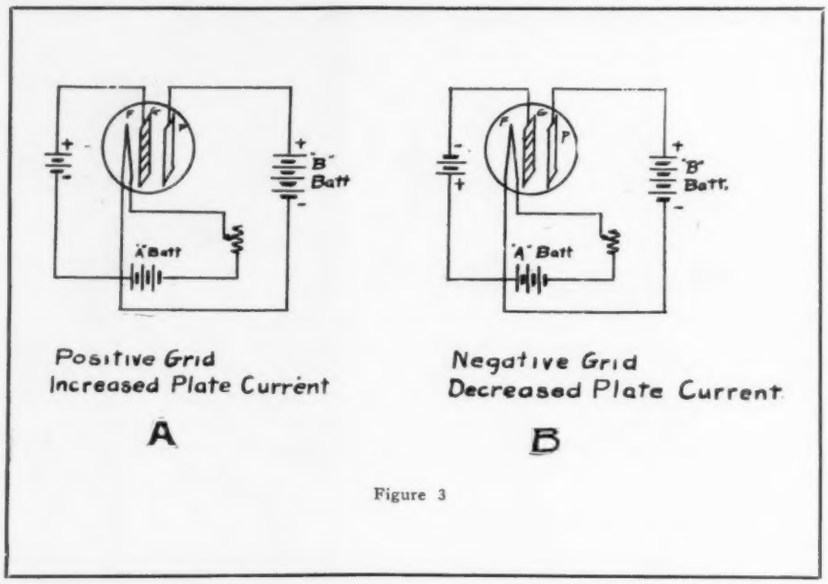


Figure 3

tive action of the grid and the plate. If the grid is made negative, as in Fig. 3 (b), it opposes the action of the plate and a smaller number of electrons flow across the space. Thus the current strength in the plate circuit may be controlled by the variation of the voltage applied to the grid.

The importance of the three element tube lies in its amplifying power. A variation of voltage applied to the grid will produce an amplified effect on the current in the plate circuit.

Expressed in another way it may be said that a change of one volt in the potential between the grid and the filament will produce as much change in the plate current as a change several times as large in the voltage applied to the plate. The ratio of the changes in plate and grid voltages to produce the same change in plate current is called the amplification constant of the tube and in the types now in use may run from 5 to 40.

The relation between the voltage applied to the grid and the current in the plate circuit is a very important one. The curve representing this relation is shown in Fig. 4 which is the actual characteristic curve of a certain type of tube used as a detector and amplifier tube in radio telephone and telegraph receiving. From the characteristic it will be noted that no current will flow in the plate circuit if the grid voltage is more than 4 to 6 volts negative. At about 18 to 24 volts the curve flattens out, indicating that an increase in positive voltage applied to the grid does not increase the plate current. This is due to the fact that at these voltages all of the electrons that are thrown off from the filament are drawn to the plate. Many features of the action of the electron tube can be explained from the characteristic curve shown in Fig. 4.

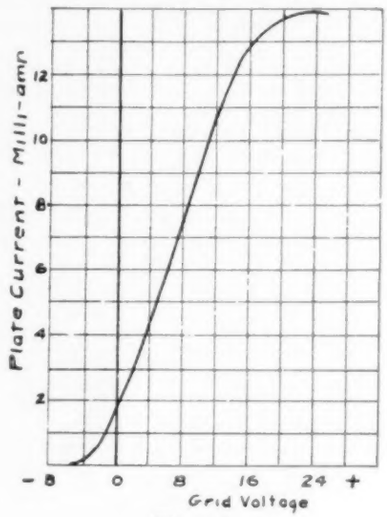


Figure 4

VAIL HELPED MOST

Veterans Vote Late Bell Head Prime Promotor of Telegraph and Its Operators

Chicago, Ill.—The Old Time Telegraphers' and Historical Association, which is to hold its annual convention in Chicago in September, recently completed a post card poll of its members to determine the five men who did most for the commercial development of the telegraph and the welfare of telegraph employees.

B. E. Sunny, of Chicago, president of the organization, announces that Theodore N. Vail leads with 392 votes. Following the deceased Bell chief, came General Thomas T. Eckert, J. W. Mackay, Robert C. Clowry and Andrew Carnegie, in the order named.

GIGGLES FROM GRIEF

Tales of Trouble That Have Made Men Prematurely Gray Headed.

New York City.—T. T. Cook, editor of one of the Bell's niftiest and livest house organs invited his contributors to kick in with queer tales of trouble. Apparently a deluge followed, and here are some of the yarns, condensed, of troubles that corrugated many a lofty expanse of brow:

Noisy lines for about a half an hour every evening. Lineman found a man sprinkling the street so that the stream of water went up into the wires, partially crossing and grounding them.

Small brother of lineman's "sweetie" was reaping harvest of dimes and quarters in hush money during the lineman's visits. Frequent trouble near the fair lady's home. Cause traced to brass curtain rod applied *by* small brother. Rod applied *to* small brother. Trouble and brother cured.

Lineman complained to wire chief that balky horse prevented him reaching scene of trouble. Chief suggested wiring generator of test set to horse's bit and tail. Eight minutes later lineman calls from 37 miles farther down the line and gasped: "It worked O. K. but now every time I try to ring in on the line the damn horse runs away."

Fishhawk's nest was causing high resistance cross. Lineman destroyed the nest once, but the hawk rebuilt it. On the second visit to the trouble an egg was found and as the lineman was about to throw it to the ground the game warden arrived and warned that destruction of the egg called for a $25 fine. Lineman decides to risk the fine before more eggs were laid. Finally kids the warden out of his decision but has a tough time fighting the hawk before it arranges for permanent residence elsewhere.

C. B. Cheadle New Counsel of Illinois Association

Springfield, Ill.—C. B. Cheadle has been elected general counsel of the Illinois Telephone Association, to fill the vacancy caused by the death of Hon. O. F. Berry, deceased.

Red Bank Company Sells Part of Pennsylvania Plant

Cooksburg, Pa.—Property of the Red Bank Telephone Co., located in the district north of Clarion river, to and including Cooksburg, has been sold to the Forest Telephone and Telegraph Co.

Here are the switchboard demonstrators and the entertainers recruited from the Kansas City company's own staff: Back row, left to right: Violet Rose, Irene Klein, Helen Stewart, Gladys Graves, Elizabeth Stalzer, Agnes Luff, Margaret Doleshal, Beatrice Brown, Alice Bodkin and Mrs. A. Cozad; front row, left to right: Irene Skinner, A. Armstrong, Mary Collins, Dorothy Steinmetz, Clara Tobie, Nettie McCullough, Ruth Harnett, Marie Werne and Fern Mark. Inset, Carrie Lee Thomas, Manager of Operators' Training School.

—Photo by Hodges

Sugar Coats Education Pill

Kansas City Telephone Company Employees Stage a Combination Demonstration and Vaudeville Show That Interests, Instructs and Amuses Audiences

By Staff Correspondent

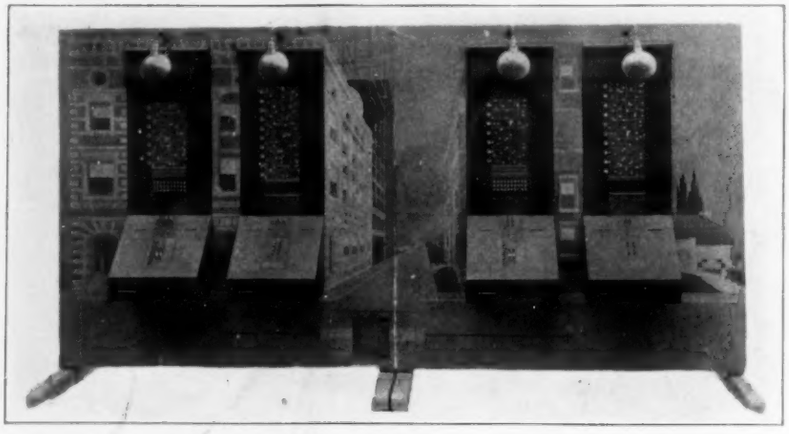
Kansas City, Mo.—For a number of years the Kansas City Telephone Co. has been endeavoring to interest subscribers in visiting the central offices for the purpose of giving them an insight into that part of their business which most directly concerns the subscribers during their everyday life. In addition to this, a program of publicity has been carried on through the newspapers telling the public in an understandable way the story of their business. It has been generally considered that the subscribers judge the service by the results obtained from the handling of their calls through the central office rather than by the installation of telephones, clearing of trouble, handling of accounts, etc. While a limited success was obtained by the plan of having subscribers visit the central offices, it was found that not a sufficient number of subscribers realized the value of having a comprehensive understanding of what happened in the central office when they originated a call, and the call completed to the called subscriber.

In casting around for a plan by which the interest of the public could be stimulated, the telephone company decided to take the central office to the public in the form of a demonstration showing the method of handling certain phases of calls through the switchboard.

The first step was to obtain sufficient detail information from other companies that had already placed the plan in operation. P. H. Hopkins, Vice President of the company, visited Detroit and other cities where the plan was in operation, studying the entire arrangement and its effect on the public of the various cities.

Booking the Show

The next step, and one which was thought of great importance was to ascertain just how much talent was available for the entertainment part of the program which was to be built up around the switchboard demonstration. Questionnaires were sent out to all the departments and it developed that sufficient talent was available to round out a well balanced entertainment. The working up of the entertainment was in the hands of Mr. Hollis Flanagan and the training of the personnel for the switchboard



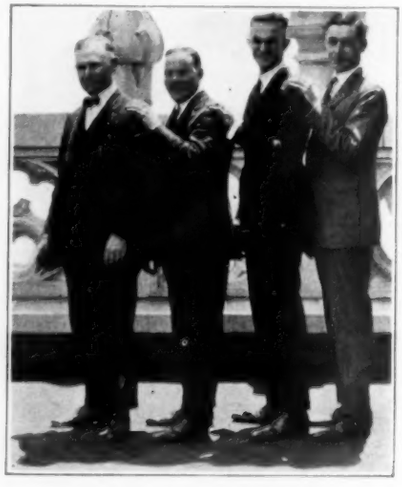
This Demonstration Board Held the Spotlight

demonstration was in charge of Miss Carrie L. Thomas, Manager of the Operator's School, Traffic Department. As soon as the training was under way, the next important step was to secure booking before the various civic organizations of Kansas City. The first showing before a civic organization was before the Chamber of Commerce, Kansas City, Mo., on May 3rd. A dress rehearsal had been given previously before the employees of the Telephone Company. Since the first showing before the Chamber of Commerce demonstrations have been given before twenty church and civic organizations.

Up to this writing the demonstration has been shown before approximately 3,000 people. After the first showing before the Chamber of Commerce, requests came in very rapidly, due no doubt to the very favorable comments from those present and to favorable mention in the news columns of the daily papers that the demonstration was in itself educational as well as a clever idea.

"Goes Over" Big

The Kansas City Telephone Co. feels that an immense amount of good has been accomplished by the demonstration. One of the outstanding points noticeable in all the audiences before which the demonstration was made, is that the interest throughout the entire program, especially the switchboard demonstration, has been very well sustained. Much favorable comment was expressed as to the manner in which the switchboard demonstrators put over their story. Credit should be given to Miss Thomas, who had the training of the personnel of this branch of the program in charge. It seemed to those who heard the talks that the speakers were professional rather than employees of the Company. The discourse by the well trained young ladies on the various phases of handling A and B calls received special commendation. To remove any stiffness of the demonstration a number of conditions met with by subscribers



Big Time Quartet Stuff Was Supplied by F. F. Holmgren, W. E. Anderson, L. C. Winkler and Hollis Flanagan

in their daily use of the service were demonstrated, such as: why there was no one on the line when a subscriber answered his telephone, the receiving of wrong numbers due to calling a number from memory, why hubby received a "don't answer" when his better half was at home, why a called subscriber received a long delay before the called party answered, etc. When this part of the demonstration was going on it was evident from the actions of those present that the lessons were going home.

At noon-day the program was cut down as practically all of the civic organizations at the noon-day luncheons allow only thirty-five minutes for a program. The entire program run in the evening at churches and other organizations consumed practically one hour.

The following shows the arrangement of the program used at evening demonstrations. A printed program is distributed to those present:

1. Introductory remarks.
2. **Vocal Selection—Male Quartet.**
3. Reading.
4. **Vocal Selection—Male Chorus.**
5. Switchboard Demonstration.
6. Telephone demonstration based on experiences you may have had.
7. How long distance calls are handled.

The following is in general the different phases of connections which were demonstrated:

Answering and completing a local multiple call.

Completing a call to an exchange other than the one in which the call was originated.

Multiple markings such as telephone discontinued, party line markings, etc.

How operator knows the line is busy.

How operator knows that the subscriber had more than one line.

What happens when subscriber moves the receiver up and down too rapidly on recalls.

Lay Off in Summer

Bookings are still coming in for the demonstration but it is expected on account of hot weather to close the program on or about June 1st, continuing later in the fall with the added feature of demonstration of the automatic equipment.

Some Male Members of the K. C. All Star Troupe. Back Row, Left to Right, P. P. Herrington, C. H. McPherson, R. H. Marchant, J. Bucholz and W. E. Anderson. Front Row, Left to Right, L. C. Winkler, Roi Sanborn, J. W. Easley, H. A. Miller and Miller McVay.
—Photo by Hodges

More Tips from "Team Work"

New England Commercial Expert Tells How to Attain Balance Between Value and Cost of Service—Benefit Gained by Rate Engineer and Field Force Co-operation

By Lambert N. Whitney

Similarly, conspicuous conditions are present in connection with some classes of our measured residence service, coin box service, toll service and service at the smaller exchanges, where the value to the patron, of the effect of some of the production costs on the product itself, is probably out of balance with such costs. Among our many products there must be numerous unseen opportunities where we should obtain the counsel of our patrons in better securing this balance between costs and value, so essential to any business; and the effects of which, on account of the vast sums involved in our continuous and extensive development, must be enormous.

Granted then that the continued success of our business depends more than ever upon a carefully adjusted relation or balance between variations in our production costs and the resulting variations in the value of the product to the patrons; that this is to be obtained in different ways in different communities; and that the decision as to the value of our product (service) rests with the patron. I believe a suggestion to solicit the assistance of the field forces in ascertaining this value and providing for this balance becomes more than a proposed procedure and is really a recognition of very and important business principles.

There would seem to be no more reasons why the employees, who are continuously in close touch with our patrons and familiar with the patrons' valuation of our service, should wait for specific complaints before conferring with those familiar with production costs, in an effort to improve the relation between such costs and values, than that they should wait for specific complaints before inquiring as to whether changes in our sales practices will effect improvements; and since the money involved in producing service is many times greater than that involved in selling and collecting for the service, the field of production economies is even more fertile than the field of sales economies in which such good work has been done by the field forces.

This installment concludes a classic on collective administration, which was begun in the June TELEPHONE ENGINEER. Its suggestions, applied to any organization, point the way to decidedly larger profits.

A good start has been made along this line in connection with the budget work, the New Hampshire plan of revenue and expense data, the Metropolitan plan of questions and answers, etc., which clearly indicates that the employees are ready, able and anxious to do such work. But the idea has not been emphasized as it should be, and to do so requires a defined leadership, interesting talks by executive and operating department heads, etc., that will provide for a continuous dissemination, throughout the organization, of inquiries, suggestions and results involving production costs and corresponding service values.

The necessity for such educational work between departments and within departments and for sustained, continuing, regular day-to-day personal efforts along this line cannot be too strongly emphasized. It involves continuously training employees to encourage, and then to appreciate fully and weigh carefully, our patrons' numerous questions and intimations regarding our product as furnished; and from these to develop, in conference with those familiar with production costs, modifications of the product that will be mutually advantageous and suited to the requirements of our patrons in the many classes of communities we serve. The program should be launched from a broad platform of the most desirable service to our patrons; and be administered as an integral part of our work.

Rate Engineer Assists

If we are agreed, then, that it is desirable further to develop the distinctively individual interest which provides the cumulative advantages of a collective administration, for assembling and efficiently arranging the thoughts of all (with which we have had so much success in connection with our sale of service—commercial expenses and public relations) to include production of service — capital and production costs. I suggest that we enlarge our rate engineer's work to include more intimate counsel with the field forces and patrons, as to the value of various elements of service, and so make him what might be called a production engineer. This in the same way that, through more intimate counsel with the field forces and patrons, we enlarged the work of the methods engineer and made him a sales engineer.

This suggestion is the result of numerous discussions with the field forces, which have developed the belief that our employes, with few exceptions, are anxious and able to do much along these lines and that they are doing little because they have not been directed, trained or really given anything like the chance they have with the sales end of the business. To really confer with a chief operator, collector, or other field employee, regarding changes in our product, may appear unusual, but it is a simple recognition of the laws of teamwork, and which are as immutable as the laws of chemistry. It is believed that the suggested position in the Commercial Department will assist along these lines, and that it should probably be supplemented by similar positions in other departments.

To carry out fully this idea, the employees in our different units must have the advantage of knowing about the production ideas in other units. These production engineers would, therefore, as in the case of the sales engineer, observe and discuss our products with the field forces, and suggest ways and means whereby im-

provements have been made or suggested in different parts of the territory. This work would be conducted openly and in such a way that the employees will not only be willing, but anxious to discuss the difficult situations which they encounter, and have the results (whether good or bad) of their method of handling such cases understood and discussed.

The production engineers would bring up for study not only instances where specific complaints or suggestions have developed with reference to our product, but also instances (involving either patrons or employees) that are only indicative of complaint or suggestion, and see that the various forces are advised accordingly. This would not be with the idea of dictating how specific situations shall be handled by specific employees, but in order to give the individual employee a better perspective of the job as a whole, and an opportunity to thus select the way in which he or she can best handle the situations as they develop in their respective communities. That we lost much by not knowing, studying and conferring among ourselves about conditions that leave lasting impressions on our patrons or employees, although resulting in no specific complaint, is, I think, apparent to us all.

Other Advantages Obtained

I believe that the general procedure as outlined will not only secure improved production, but will also help to develop a higher morale of the forces, for no one really likes perfunctory work in connection with any part of the job. The desire to confer, to represent and to be consulted, is fundamentally human, and the ability to do this with reference to production costs will develop quickly if we provide for proper discussion as to why we furnish this particular service, what is its real value to the patron, would something else involving less production cost be acceptable, etc. Again, in making it clear that the management assumes no monopoly of the brains of our business, but, without sacrificing its right to decision, wishes the counsel of its field forces and its patrons with reference to its products and their associated costs, we are recognizing that indefatigable desire to participate in management; and are, consequently, helping to develop a most desirable trust in the management on the part of both employees and patrons—that is, good personal and public relations.

I believe the suggested procedure will also assist in developing one of the prime essentials of successful commercial work, i. e., good salesmanship—and which obviously requires a general knowledge of the costs of the product to be sold. Such knowledge insures an ability to discuss intelligently the reasonableness of the price—an ability that is doubly essential with a non-competitive product like ours where the customer can make no price comparisons with similar products of others.

Furthermore, we are rapidly approaching the time when a proper distribution of our securities among employees, subscribers and even others, will be obtained to a considerable extent through the knowledge and activities of the field forces. That the work which has already been done in connection with selling methods, supplemented by the suggested work with reference to production methods, will do much to prepare the way for such coming securities work is obvious; for the fundamental of success in the latter is a knowledge that the real value of the product, its price, its associated production costs, and the sales methods are all properly arranged. So the suggested procedure is quite desirable as an educational process for work to come.

I believe also that such a procedure will tend to bring forward a number of what may be called "exceptional" employees who are especially interested and capable. Such employees will be quickly recognized by all as the ones to be advanced to higher positions first; others will more slowly develop increased interest and ability and be similarly recognized as the ones to continue where they are for a time; then there will be others with a conspicuous tendency to continue indefinitely in their present positions.

All this will materially assist in moving employees around so as to develop properly their ability, place them in the right job, and avoid the tendency that has sometimes existed in the past to the effect that seniority is a proper basis of promotion; and which has the decided disadvantage that individual progress is too slow for the best people (with the result that we either lose them or they lose their enthusiasm and ambition), and too fast for the less efficient people (with the result that the organization as a whole is weakened). We would thus assist in providing for that delicate adjustment among exceptionally capable employees, promising employees and the other employees, that insures a generally satisfied personnel, and which in turn provides for obtaining, holding and developing a high grade and satisfied force.

Opportunity Worth Consideration

Summed up, my desire this evening is to emphasize two facts—first, that our management solicits the counsel of its employees and patrons regarding the maintenance of a business-like and satisfactory service. Second, that, as in any other business, such a service requires a substantial margin from its production costs to the Company up to its value to the patrons and within which margin lies our rate; that if our business is to be stable we must include in the "engineering" of our rates a careful consideration of the differing production costs resulting from variations in our products, with the corresponding values of the products to the patrons; that properly to obtain these costs involves the counsel of our associates; that properly to obtain these values involves the counsel of our patrons, and that to thus obtain and balance these costs and values provides a valuable business opportunity for all of us.

Then there is the suggestion that the opportunity be encouraged under the direction of specified people and the further suggestion that such a procedure assists in providing better personal and public relations, in preparing us for a new class of work that is to come, and in developing a better balanced and more stable force. A chance to do all this, or even to help a little toward doing it, is a pretty good business opportunity; anyway I leave the idea with you as representative men of the telephone business, and thank you for the opportunity of doing so.

A. W. Miller, New York, Serene After 30,000 Kicks

New York City.—Addison W. Miller, complaint adjuster of New York Division Traffic, has completed his 30th year in Bell service. According to Long Lines he has handled 30,000 complaints from people in all walks and talks of life and has as near a 100 per cent record of satisfaction as mortal can attain.

Practical Plant Problems

Chapter V—The Development Study

By Charles W. McKay, Associate Editor

In the June installment we discussed methods of taking house count data and in connection with Fig. 3, in the June installment, a detailed illustration was presented, showing just how a specific problem would be handled. In the present installment the writer will endeavor to show the relation between the detailed house count study and the development study as a whole.

It is hardly necessary to reproduce Fig. 3, but it is suggested that the Reader refer to it, briefly. It will be noted that a "Recapitulation of Data" is given in connection with the illustration. This recapitulation gives the classification of service; present number of subscribers; estimated number for the 5-year period and estimated number for the 20-year period. In the closing paragraphs of the article ratios of two and four at stations to lines for both the 5- and 20-year periods were quoted.

Given these data, it is a comparatively simple task to determine the estimated number of lines—for a block such as the one illustrated in Fig. 3—for both the 5- and 20-year periods.

If other blocks, within the analysis area, are treated in a similar manner, the resultant data may be transferred to a suitably scaled map. This operation, it will be remembered, is the second operation involved in the development study—as outlined in the April installment of this series.

Other things being equal, it is suggested that a map of a scale of about two hundred feet to the inch be used. The data resultant from the house count studies may be transcribed to this map in the form of a "fraction". The numerator of the fraction in each city block will represent the number of lines estimated for the 5-year period and the denominator the number of lines estimated for the 20-year period.

After this operation has been completed, the next phase of the problem involves the determination of the theoretical central office locations. This task is accomplished as follows:

First, let us consider the figures representing the number of lines estimated for the 5-year period. Take each row of blocks, in a vertical direction, and total up the number of lines.

Next, add the totals, as determined by rows of blocks, in order to get the grand total number of lines.

The next operation involves the determination of the center of density in an East and West direction. In other words, we practically take the total number of lines and divide it by two, or determine a line of bisection in a vertical direction.

Next, still considering 5-year period, we repeat the operation considering the rows of blocks in a horizontal direction.

After completing this operation we will have another center-of-density line, this one extending from right to left or in an East and West direction on the map.

The point where these two density lines intersect forms the theoretical central office location for the 5-year period.

For the 20-year period, this whole operation is repeated; of course, using the 20-year-line data. In other words, the "denominators" of the figures presented in each city block.

We will probably find that the theoretical central office location for the 20-year period will far from coincide with the theoretical central office location for the 5-year period. This is just as it should be. We would hardly expect to have the center of density, either from a population or from a telephone standpoint, the same at the end of the 5- and at the end of 20-year periods.

At this juncture, it may be well to say that for our present purpose we are primarily concerned with the 5-year estimate.

Of course, it will be understood that the central office location, as above determined, is merely a theoretical one. But, it gives us a sort of a starting point—or perhaps I may better say a guide—for our future activities.

Obviously, there are many other factors to be taken into consideration. Just because the development study happens to show that there is a theoretical central office location at the corner of Avenue A and 1st street that certainly does not mean that we shall overlook the fact that there is already an existing office, let us say, at the corner of Avenue A and 3rd street, two blocks distant.

If the existing office location is desirable, from other standpoints, we may consider ourselves exceedingly fortunate in finding that our center of density and theoretical office location so nearly coincide.

On the other hand—to assume an extreme case—if the existing office is located or rented property (with a questionable renewal clause in the lease) and, furthermore, if the building is entirely inadequate for telephone purposes, we would probably be warranted in trying to purchase a new central office site as near as possible to the corner of Avenue A and 1st street—the theoretical central office site.

The writer believes that, from these illustrations, it will be obvious that the task of the telephone engineer involves not only as accurate a prognosis as possible of future telephone requirements, and the future location of telephone central offices, but also a consideration of these data in connection with existing plant.

The problem often resolves itself into one of "cut and try." First we determine the theoretical locations, ignoring the existing plant. Then, we try to see how the theoretical data may be reconciled to existing conditions.

Another factor to be considered in determining the central office district boundaries, and the central office locations, is that there may be many local conditions to be taken into consideration.

Two communities having exactly the same number of subscribers—or rather the same number of lines—may necessitate entirely different treatment as to the determination of the number of central office districts; the number of central offices, and the individual location of each central office. In one community, for instance, the subscriber development may be so concentrated that all of the subscribers may be readily cared for from

one office; while in another community, having exactly the same number of subscribers lines, geographic or social conditions may be such as to warrant the installation of several central offices.

An illustration of the point at issue may be found in a certain southern town. Ordinarily, the town would not warrant more than one central office. It so happens, however, that it has a large and comparatively prosperous negro element; and, furthermore, the town is bisected, geographically, by a small river. The negroes, in this town, are located on one side of the river and the white people on the other. Despite the fact that the negroes, in this particular town, are good telephone users, it is but natural that there is little telephone traffic between the white and negro populations. Hence, it seemed advisable to the telephone company to install and maintain two central office districts and two central offices—one at the approximate center of the white district; the other in the approximate center of the black district.

There are, however, two limiting factors common to all problems of the nature under discussion. On account of the physical limitations of the multiple switchboard, one switchboard unit cannot serve more than approximately ten thousand subscribers lines, at the very outside. Again, the length of subscribers lines, from the central office to the subscribers station, is a limiting factor worthy of serious consideration. Lines of more than two, or two and a half miles in length are rarely practical from an operating standpoint.

Usually, in making development studies, it will be found that the cost factor is an important one in determining the ultimate solution of the problem. Tentative layouts should be made for each of the plans under consideration and an estimate made of the first cost and annual charges involved.

In making these estimates the following factors should be considered:

1. Cost of subscribers' lines—including subway, cable, and line and drop wire.
2. Cost of trunk lines—including subway, cable, etc.
3. Cost of switchboard and central office equipment.
4. Annual charges on company-owned buildings—or rent on leased buildings.
5. Cost of central office operating labor.

With these five factors in mind, it is possible to prepare detailed estimates, showing the first cost and the annual charges of each of the several schemes under consideration. Other things being equal, of course, the plan that involves the lowest first cost and the least expenditure for annual charges will prove the most desirable, providing this plan will fit in with the ultimate requirements as shown by the multiple study and afford the best possible service to the telephone subscribing public.

This whole subject of the development study and its relation to the fundamental plan will be treated in detail in the August installment of this series. Maps will be presented, showing typical layouts, and the question of providing feeder and distribution facilities will be discussed in some detail.

BUILDS IN BOLIVIA

George L. Price Busy Introducing Equipment from the States

Cochabamba, Bolivia—George L. Price, General Manager of the Valley Electric Co., is planning the construction, at an early date, of a metallic circuit line from this city to Santa Cruz, a distance of 80 leagues, with branches to Sucre and other cities.

In Cochabamba, Mr. Price's plans call for the installation of a central battery system; in the cities of Quillacollo, Punata, and Totora, the use of Leich Automaphones is contemplated. At the other towns en route magneto equipment will be used.

Bids are being received from a number of prominent manufacturers now. Construction work will be begun under a full head of steam in the immediate future. Poles are up in some of the towns at present writing.

Florida Film to Teach Public—Association Decides

Miami, Fla.—Florida's public is to be told the trials and triumphs of the telephone industry by a movie, according to the plan of the first sectional meeting of the state telephone association held here. The sessions were vibrant with practical discussion and findings. Some of the features were the prophecy of C. D. Brorein that subscribers eventually would be billed on a meter basis, a discussion of attaining a united lineup of all employees in the good will campaign, closer contact with newspaper men, and consideration of seasonal rates for the winter resort traffic. Reason for telephone company complaints, in most cases, was declared by R. J. Gailbreath, of the South Atlantic T. and T., to be the public's inability to visualize the telephone company's problems. Acting on this tip, Frank Rue proposed the educational movie, which was approved. Purchase of standard equipment was strongly endorsed by W. A. Jamieson. C. W. Van Landingham spoke on employees' educational and social organizations.

Southern Indiana Sessions Well Attended

New Albany, Ind.—Under the guidance of S. M. Isom, of Mitchell, President of the Association, the Southern Indiana Telephone Association held one of its most interesting meetings here. Interesting addresses were made by Henry M. Barnhart, President of the Indiana Telephone Association, C. W. Hadlosk, who spoke on "Toll Line Maintenance," E. W. Swarthout of Aurora, speaking on "New Methods of Pole Preservation," and Prof. R. V. Achatz, of Purdue, Technical Editor of TELEPHONE ENGINEER, who addressed the meeting on "Wireless Telephony". The leading address of the afternoon session was made by John W. McCardle, Chairman of the Indiana Public Service Commission. A question box conducted by Max F. Hosea, Treasurer of the state organization, was one of the features of the meeting.

Keyes Heads Washington State Association

Pullman, Wash.—At the annual convention of the Washington Telephone Association, Edwin Keyes of Sunnyside was elected President for the ensuing term. J. C. Ruth of Pullman was re-elected Vice-President, and W. M. Anderson of Wenatchee was named Secretary-Treasurer. The next meeting of the association is to be held at Blaine.

Minnesota Spends Good Day in Conference

Owatonna, Minn. — Problems of traffic, public relations, plant and accounting were discussed during the June 21st district conference of the Minnesota Telephone Association held here. The meeting was opened by Senator Sam Rask, and numbered among its active participants, J. C. Crowley, Miss Anne Barnes, Miss Mary Pugh, James W. Howatt, William F. Foley, Peter H. Finnegan and T. C. Macoubrey.

Metamora, Ohio.—Consolidation of the Metamora Telephone Co., Richfield exchange of the Sylvania Home Telephone Co., and the Berkey Farmers Mutual Telephone Co. has been effected by the recently organized Metamora-Richfield Telephone Co.

Bell Won't Buy It Tells U. S. I. T. A.

Vice-President E. K. Hall Transmits Historic Note on Bell's Policy to Independent's Chief, MacKinnon—Both Factors United for Service to Public by New Agreement

Regulation from within, rather than restriction from without, is to be the unified policy of the telephone industry.

This is the result of a historic note from E. K. Hall, Vice-President of the Bell, to F. B. MacKinnon, President of the U. S. Independent Telephone Association, in which the Bell commits itself to a non-buying platform, with specified exceptions.

On May 8th the executive committee of the Independent association began the action which resulted in the Bell's historic statement. The Independents sought a basis for action in mergers under the Willis law, and negotiated with Mr. Hall, with the outcome given in full on the following page.

The Hall memorandum does not commit the Independent association to any particular course of action, but enables it to protect its interests. Both parties to the deal are aligned through this agreement, in the protection of the interests of the public.

Acceptance and approval of the Hall document was expressed by the Independents in the following resolution, adopted at the Chicago meeting, June 26:

RESOLVED, That the report of the Executive Committee on the policy adopted by the American Telephone and Telegraph Company as expressed in the Memorandum of June 14th, of Vice-President E. K. Hall to President MacKinnon of the Association be approved.

RESOLVED further, That the Association accepts the declaration of the Bell companies as an evidence of the spirit of constructive co-operation which is necessary to maintain harmonious relations between the two groups to continue to furnish efficient and adequate telephone service to the public.

Changing times and recognition of the capacities of the Independent organization are responsible for the difference between the Hall Memorandum and the famous Kingsbury Commitment, made to the Department of Justice in December, 1913.

MacKinnon Gives History

The first statement, says F. B. MacKinnon, President of the U. S. Independent group, was "like many such a formal pledge, too inflexible to fit in with constantly changing conditions.

"With the consent and advice of the United States Independent Telephone Association, the Department of Justice permitted adjustments of competitive situations—allowing the Bell companies to acquire Independent properties in such instances as an equal amount of plant was sold by the Bell to the Independents. But numerous situations existed where the only solution of the competitive problem was the purchase by the Bell of the Independent property without a simultaneous sale of Bell property.

"Such problems could not be solved under the 'Kingsbury Commitment.' In consequence, the 'Willis Bill' was enacted in 1921, which placed the federal authority to pass upon telephone consolidations in the hands of the Interstate Commerce Commission.

"But while the obstacles placed in the way of telephone property adjustments by the 'Kingsbury Commitment' were removed by the enactment of the 'Willis Act,' the relationship of the Bell group and the Independent group, which had been clearly defined during the life of the 'Kingsbury Commitment,' at once came to the front as a problem to be solved.

Peace or War

Should amicable relations between the two groups continue or would the Bell group, by taking advantage of its release from the 'Kingsbury Commitment,' proceed to make purchases of so many units of the Independent group as would bring about antagonism, if not actual war, between the two groups of the safest and soundest industry in the world—a war that would be disastrous to the Bell group and probably to the industry as a whole?

"The United States Independent Telephone Association, the organization representing the Independent companies of the United States on country-wide national questions, took the position that in the protection of its members, it must either be advised in advance of all proposed transfers of property from the Independent to the Bell group or it must go before state and federal regulatory bodies and formally object to such transactions as might be deemed detrimental to the Independent group.

"The 'Hall Memorandum' means that the Bell group desires to cooperate with the Independent group for the good of the industry.

"A Solemn Pledge"

"'The Hall Memorandum' is a solemn pledge to the people of the country that the Bell group has no monopolistic designs and recognizes the value of making all its moves in the open and doing its part to preserve the integrity of the Independent group.

"The 'Hall Memorandum' is a statement of policy that is of the greatest importance to the public as well as to the telephone industry. The 'Kingsbury Commitment' was carefully observed. So will be the 'Hall Memorandum.'

"The association should realize the responsibility placed on it in this formal public way. From now on the public will hold the association accountable for the propriety of transfers of telephone properties, will look to the association for a constructive attitude, and will depend upon it for advice in regulating the two groups and the telephone industry as a whole.

"By this memorandum a new relationship between the Independent group and the public has been established. The association, as the representative of that group, must actively meet its responsibilities.

"A Fine Spirit"

"This new declaration of the American Telephone & Telegraph Co. should be accepted in the fine spirit of fairness and honesty in which it is made and should be regarded as the expression by a great organization of a genuine desire by frankness and cooperation to continue to build up the great telephone systems of the country."

American Telephone and Telegraph Company

Telephone and Telegraph Bldg.
195 Broadway, New York

New York, June 14, 1922.

Mr. Frank B. MacKinnon, President
U. S. Independent Telephone Assn.,
Chicago, Illinois.

Dear Mr. MacKinnon:

As per your suggestion, I am sending you this memorandum to confirm our recent conversation concerning the general policy of this Company and the companies associated with it in the matter of the purchase of or consolidation with other telephone companies not owned or controlled by us.

First of all I wish to reiterate in just as strong language as I can state it, that the report that this Company and its associated companies have adopted or are about to adopt a general policy of purchasing or consolidating with connecting or duplicating companies is entirely without foundation. As a matter of fact, the general policy of this Company and its associated companies is today, and so far as we can foresee will continue to be, not to purchase or consolidate with connecting or duplicating companies except in special cases. In other words, any case of purchase or consolidation would be an exception to our general policy rather than in line with it and have to prove itself in as such.

We should consider that such an exception was proved in only in cases where it seemed to be demanded either

(1) For the convenience of the public as evidenced by the wishes of State authorities or by local public sentiment in or adjoining the territory served; or

(2) By special reasons which made the transaction seem desirable and essential from the point of view of the protection of our own property or the general public service.

Presumably most of the cases which would come up for consideration as exceptions under the first classification would be cases where there is now duplication of service which the public desires to have unified. The solution of problems of this nature can be approached in any one of four ways, either (a) by the sale of our property; (b) the purchase by us of the other company's property; (c) by some method of consolidation of the companies; or (d) by working out some division of territory.

As cases of this kind are, from time to time, presented for consideration, we would undertake to work out an arrangement in whichever of the four ways seemed to be best suited in the long run to meet the public interest.

Referring to sales by us, perhaps I ought to add that in the past there have been cases of real hardship on the part of some of our older employees who have lost their standing and benefits under our Benefit Plan through our disposal of our property. We feel that we should in the future guard so far as possible against any recurrence of such cases, and this may have a tendency to operate against sales by us except in cases which similar protection for these employees can be arranged for by the companies desiring to purchase.

Types of cases which might be expected to come up for consideration under the second general classification would be:

(1) Companies in which we now have a disproportionately large investment without actual control.

(2) Cases where connecting company or other telephone property is pressed for sale, and where it seems that the general public service will be improved by its operation as an integral part of our service.

You made the point in our discussion that the purchase of or consolidation with a given Independent company by us might involve the connection or interests of other Independent companies, and this point seems to be well taken. To meet this situation, we propose in any future negotiations to stipulate that your Association or such officer of the Association as you may designate shall be given notice of any such proposed transaction at least thirty days before the parties conclude any formal agreement—such notice to be given by the negotiating company, in cases where such company is a member of your Association, and in all other cases by ourselves. It would seem to us that this would give any of your members whose interests might be affected by the result of such negotiations a full opportunity to be heard and of making sure that their own connections and interests are preserved.

Furthermore as suggested by you, in cases where negotiations finally result in an agreement and the transaction requires the approval of either a State Public Utility Commission or the Interstate Commerce Commission, we propose to provide, through stipulation with the contracting party, that a general statement setting forth the nature of the proposed transaction is sent to your Association at least thirty days before applicaion is filed for approval of the transaction by such public authorities. In case the proposed arrangement requires the approval of more than one Commission such notice to be sent thirty days prior to the filing of the first application. This would seem to provide ample time and opportunity, if any is desired, for any company whose interests are involved in the proposed transaction to prepare for having its interests fully presented and considered in connection with the proposal under consideration.

In closing I would like to repeat my statement made during our discussion that it is our desire to co-operate in all possible ways with the members of your organization and to preserve and extend the cordial relations now generally existing in the telephone industry.

Very truly yours,

(Signed) E. K. HALL,
Vice-President.

W. J. Stanton, War Hero, Returns to Monarch Fold

Fort Dodge, Iowa.—His first love has reclaimed Major W. J. Stanton. This widely known veteran has returned to the Monarch Telephone Mfg. Co. to represent it in western Iowa and Nebraska. Years ago he was in charge of the Monarch sector in Indiana and Ohio, leaving that territory in 1912 to take charge of the Monarch's Dallas branch. Early in 1917 Stanton went to France as captain of field artillery and quickly attained a majority. He was twice wounded. He was cited for "exceptional efficiency, loyalty and distinguished attention to duty." He was among the last of the A. E. F. to leave France. Since his return to the United States he has been regaining his health at his old home in Texas and now feels fit to fight his weight in wild cats and give the cats the first two bites.

Oklahomans Confer at Poteau—District Meet a Success

Poteau, Okla.—Under the leadership of J. W. Walton of Broken Arrow, and L. W. Scherer of Yale, the second of a series of district meetings for telephone men and women has been successfully held at Poteau. A good attendance witnessed the operators' school and listened to practical addresses: on commission work by Campbell Russell, chairman of the Oklahoma Corporation Commission, on plant construction and maintenance by F. G. Haukenbery of Tulsa, and other Southwestern Bell men, and on public relations by H. W. Hubenthal, telephone engineer of the state commission.

Independent Pioneers Reunion October 26, at Chicago

Chicago, Ill.—October 26th, during the annual meeting of the U. S. Independent Telephone Association at Chicago, the Independent Pioneers' Telephone Association will hold its yearly banquet. Extension of the Pioneers' activities to include powwows at the various state meetings also was considered at the meeting of the executive committee of the organization, recently held in Chicago. President H. L. Beyer has appointed as luncheon and program committee, W. S. Vivian, chairman, E. C. Blomeyer, Frank Eldridge, Cooper Wilkins, H. D. Currier, J. F. Jaap, George Rodormer and Carl Shafer.

Detroit, Mich.—Dean John A. Russell of the University of Detroit is working out a public utility course to be established by the institution beginning the next academic year.

OPINIONS AND COMMENTS

A NEW STATEMENT OF BELL POLICY

An announcement of outstanding importance to the entire telephone industry is contained in the statement of policy of the Bell interests relative to the purchase or consolidation with Independent telephone companies.

The "Hall Memorandum" transmitted by Vice-President E. K. Hall of the American Telephone and Telegraph Co. to F. B. MacKinnon, president of the United States Independent Telephone Association, will go down in telephone history as the successor of the now obsolete "Kingsbury Commitment."

As President MacKinnon says, the "Memorandum" is a solemn pledge to the people of the country, although given directly to the Independent Association, just as the "Kingsbury Commitment" became a solemn pledge when it was given to the Department of Justice. It should go far toward eliminating the uncertainty that has arisen through the operations of the Bell in purchasing competing plants since the passage of the Willis Act.

The memorandum contains a strong statement that the policy of the Bell companies is not, and as far as can be foreseen will not be, one of purchase of duplicating or connecting companies except in special cases. Such exceptions in the case of competing plants might arise when consolidation is demanded by public sentiment or desired by state authorities. Four solutions are stated: by purchase, by sale, by consolidation and by division of territory. While the memorandum says that the method adopted would be the one best suited in the long run to meet the public needs, it hints that there may be factors which will tend to operate against sales, but the reason given, namely, the protection of employes of long service is scarcely convincing. Independent companies have obligations of this kind also.

The Bell companies, of course, reserve the right to purchase and consolidate where they have large financial interests in other companies without having actual control when it is necessary to do so to protect their own financial interests. They will also consider exceptions to the policy where they are pressed to purchase other companies and where it seems advantageous to do so. These provisions leave the way clear for the ultimate consolidation into the Bell subsidiaries, some of the third companies that have been formed to take over both Bell and Independent plants, particularly where the Bell has control or a large minority interest.

Probably of greatest interest to the Independent manager who has not considered the possibility of sale of his own plant to the Bell, are the provisions for notice to the Independent Association thirty days in advance of the conclusion of a formal agreement and again thirty days before submission to regulatory authorities for approval. This would seem to give ample time for interested companies to take such action as might seem necessary to protect toll and connecting contracts and other interests that might be involved.

There is evidence from some of the discussion that the statement of policy was not obtained without some effort and it was largely through the work of President MacKinnon of the Independent Association that it was secured. Since the Association is the official means through which the industry will be advised of pending negotiations, membership in it becomes all the more important to the individual companies of the country.

The "Hall Memorandum" will, without question, become one of the milestones in the history of the telephone industry of the United States. It will remove the doubt that has existed as to the intentions of the Bell and will permit those responsible for the operation of independent properties to go ahead with developments with confidence in the future. TELEPHONE ENGINEER has commented on this editorially before and has stated its opinion that the manager and owner who desired to stay in the telephone business and develop his property had little to fear. He now has the added assurance that he will have opportunity to protect his interests in case of sale of neighboring properties. The way is open for the development of cordial and harmonious relations in the telephone industry that will give to the public a maximum of service both in quantity and quality.

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TAKING A VACATION

We recently heard an executive of a telephone company say that every one of the force except himself could take a vacation, but that he could not leave as there was no one to run things while he was gone.

We are convinced that this man owes it to himself and to is subordinates to take a long vacation.

Perhaps he is in no particular need of the restoring properties of a change of air and of the freedom for a few days from the ordinary cares of life. What he really needs is a change of ideas, particularly in respect to his being indispensable to the business. Let him take a month of vacation in some inaccessible place, where even his mail can not reach him, and he will come back to find things have not changed much and that the plant ran along very nicely without his immediate supervision.

People have a way of rising to the occasion when responsibility is placed on them. Some of the latent talent in his organization would have a chance to develop, a thing which it can not do at present. We do not mean by this that he is a failure as an executive. By no means. He has an efficient and smooth running organization, handicapped only in one respect, that it depends too much on himself.

Not only he, but the whole company needs a vacation, to readjust things along a little more healthy lines.

900 PROOF PRESS POISON

An unsatisfactory answer to that query, "The United States Is, or Are," has been given by the factors in congress responsible for the inequitable postage rates magazine and newspaper publishers are being compelled to pay.

The answer that has been given by the action of these politicians is, "The United States aint!"

The congressmen have thought that it is perfectly in accord with American policies to compel American citizens to pay for their information according to their distance from the source of supply. There seems to be no thought of national unity.

This amazing conclusion was responsible for the zone postage regulations which were put into effect during the war, and still prevail as a handicap to national unity, equality and freedom of expression.

When the restrictions were imposed the publishers were too busy helping fight the common cause to put forth successful opposition to the archaic taxation. Other onerous and uncalled for taxation brought about during the war has been repealed, but still the magazine readers, advertisers and publishers are paying as high as 900% penalty because of this hastily imposed measure.

A congressional commission has reported that "second class matter is itself the cause of a great volume of first class matter upon which the (postal) department reaps a handsome revenue." It would seem to a business man that such a revenue developer might have a little encouragement, or at least, consideration.

It's a great life, mates, where the shoemaker's kids roam about barefooted, and the publishers are able to take an effective part in almost every attempt to get a 50-50 deal with congress, except in the case of their own particular misery.

Ladies' Days at Hoosier's Picnic

Lake Wawasee, Ind.—Northern Indiana's summer meeting held here June 14-16 turned the spotlight on the women of the business. The program was devoted principally to the work of the operators, and the majority of the papers were presented by the gentler sex.

"Letting Georgine do it" was said by F. V. Newman of Laporte, President of the Northern Indiana Telephone Assn., to be too much the policy of many managers, especially in traffic affairs. He advocated a complete consideration of the operators' personal convenience while at work, and encouragement of educational work among the operators.

What the Ladies Had to Say

An interesting program of papers from the feminine angle was presented; among them being "High Spots in the Telephone Profession," by Maybelle Cavanaugh, Laporte; "Responsibilities of the Small Town Operator," by Ethel Anglin, Leesburg; "Why We are Glad to Meet the Operators of the District," by Rebertha Lightfoot, Wabash; "Accuracy and Speed," by Ethel Payne, Logansport; "Co-operation," by Belle Bernetha, Rochester; "Friendliness by Operators," by Loretta Pesch, Plymouth; "Training of Operators" by Marguerite Norris of Laporte, "Terminating Toll Centers," by Kitty Williams of Fort Wayne; "Timing of Toll Conversations and Report Charges," by Nell Bolan of South Bend; and "Handling of Cords," by Grace Hatfield of Laporte.

Further attention was paid the operators in the talk of W. S. Vivian of Chicago on "The Whys of the Operators' Convention," and that of E. C. Blomeyer on "Relations of the Utility to the Public." According to Mr. Blomeyer the sting may be taken from a telephone bill if the charge is received by some winsome young woman at the cash register.

"Public Utility Regulation" by Albert Stump of Indianapolis presented a strong and interesting case for the regulatory bodies. Another treatment of regulatory matters was given in the address of John W. McCardle, Chairman of the Indiana Public Service Commission. Attacks on the commission by sniping politicians were subjected to keen and disintegrating analysis by the Indiana expert. Indiana ranks seventh among 35 states in its number of public utilities, and its utilities have the lowest average rate among the 35 states, Mr. McCardle said. During the years 1917-1921, 116 rural telephone companies average rate increases of 54.5 per cent were granted, and 23.2 per cent average increase was granted in the larger cities.

A new administration was elected at the Friday morning business session. Heading the new officers is R. L. Miller of Syracuse. Harry Phend of Milford was elected Vice President, Wilbur Van Horn, Sec.-Treas. and C. E. Koontz of Bremen and Sam Tomlinson of Plymouth, directors.

J. K. Johnston of Indianapolis presented a practical address on radio telephony. He forecasted radio as an imminent accessory to the telephone business as conducted today.

Type A 27 Pole Cable Terminal

Type A27
Pole Cable Terminal
Fits Pole
No Gaining

Equipped with P495
Self-Cleaning Sawtooth
Discharge Blocks
Without Extra Charge

Reliable Electric Company

3145 CARROLL AVENUE CHICAGO, U. S. A.

P495

6,000% Profit to North Dakota Users

Mandan, N. D.—Some highly interesting figures on the actual value of telephone service were given in the paper by J. P. Smith of Beach on "Value of Telephone Service," which was read at the 16th annual convention of the North Dakota Telephone Association.

Basing his estimate on the effort that would have to be made by the subscriber if he had no phone, Mr. Smith demonstrated that telephone service returned a profit over its cost to the subscriber of 1,000% to 6,000%. In Mr. Smith's determination he considered the subscribers' time as being worth 48 cents an hour. In arriving at the above result Mr. Smith based his compilation on the subscriber making personal, instead of telephone calls.

Getting convincing proofs of the value of the telephone across to the public was the keynote of the meeting. William McEachron of Park River, with an address on "How to Present Our Case Best to Our Neighbors and Our Public," L. D. Richardson, of Fargo, with his remarks on public relations, and the two nationally known star performers, W. S. Vivian and C. C. Deering, gave the assembly practical pointers on good will building.

The telephone company's duty in convincing the public, as well as the commission, that it needed a rate increase, was emphasized by W. H. Stutsman and Frank Milholland of the North Dakota Railway Commission. This suggestion was interjected in a spirited discussion which followed a talk on "The Depreciation Reserve and Its Importance," by J. P. Smith. Commission relations also were handled in the address of E. A. Prendergast, general solicitor of the Northwestern Bell, on "The Proper Preparation of Reports and Cases to Come before Various State and Federal Commissions and Courts."

R. H. Fair, General Plant Superintendent of the Northwestern Bell, spoke on "Interferences of High Tension Transmission Lines," recommending an annual discussion on this and other technical matters.

C. C. 'Converse, tax commissioner of Bismarck, N. Dak., in his address on "The Assessment of Telephone Properties," said the extravagance of the public's administration these days was responsible for the unreasonably high taxes utilities are compelled to pay.

Entertainment features of the meeting were a switchboard demonstration, musicale, and showing of the film, "The Story of the Telephone," Tuesday evening, and on Wednesday evening the annual banquet, at which Jay Houghtaling of the Northwestern Telephone Equipment Co. acted as ring master.

To steer the association through another successful year the following officers were elected: President, M. M. Borman, Abercrombie, N. D.; vice-president, H. A. Brown, Cooperstown, N. D. A. J. McInnes, Dazey, N. D., was elected secretary, following his noteworthy service as president during the previous year.

The association resolved to conduct six traffic schools of two days each, and six plant schools of two days each, to be held in different parts of the state.

Valuation in Rate Making

Chapter VI—Inventory of Underground Plant

By Charles W. McKay

In the June installment we considered the inventory of the rural and toll plant, and one of the methods for recording the inventory of the aerial cable plant. In connection with the latter, it may be said that there are other excellent methods for recording data as to this portion of the plant, but, unfortunately, time and space do not permit of a more detailed discussion at this juncture.

Foreword as to Underground Inventory

As suggested in the closing paragraph of the June installment—methods of recording the data as to underground conduit and cable systems will be discussed in the present installment. At this juncture, two thoughts suggest themselves which seem worthy of transmission to the reader. In the first place, a word as to the importance of accuracy in recording underground data—especially in the large cities—may not be amiss. In the smaller towns, of course, the value of the underground plant is not appreciable—as compared with the value of the plant as a whole. In the large cities, however, the major portion of the company's investment in outside plant is tied up in underground cable and conduit systems.

This "word of caution" as to care in recording underground data has been suggested by the writer's own experience in the work involved in this portion of a telephone inventory. Underground systems are complicated and it is a very easy matter to overlook portions of the plant and it is just as easy to incur duplications and inventory.

As an illustration of the foregoing the writer will cite a specific case. Some years ago an appraisal was made of the telephone plant in one of the largest cities in the country. Every effort was made on the part of those in charge of the appraisal to exercise due diligence in carefully instructing—and supervising—the field men, to obviate the possibility of inventory errors. Despite all precautions, however, it was subsequently found that an appreciable amount of underground conduit, manholes and cables had been omitted entirely. In this particular instance the omission was due to the fact that the portion omitted consisted of a number of small units of "detached" conduit. In other words, in certain places—in connection with the aerial cable system—it had been deemed advisable to install short isolated sections of underground plant, each involving several manholes and several hundred feet of conduit and cable. Obviously the men assigned to the inventory of the underground plant were not responsible for the error involved in overlooking this conduit. On the other hand, the men who recorded the data for the aerial cable plant were not properly informed as to the location of the section in question—due to faulty records in the company's office.

The foregoing illustration is merely cited to emphasize the importance of care in providing for the inventory of the underground conduit and cable plant.

The second thought that suggests itself—as being pertinent at this phase of our discussion—is that in discussing the inventory methods we are confining ourselves to purely inventory problems. As previously suggested it is customary to provide for the determination of the present, depreciated value of a telephone plant—in connection with the task of recording inventory. However, for our present purpose, it seems better to postpone this phase of the problem until after we have considered the theory of depreciation. In other words, it seems to the writer that a joint discussion of inventory and depreciation problems is apt to prove confusing to the reader.

To return to the subject of the inventory of underground systems—the inventory of the underground conduit plant should be so constituted as to include all conduit, pipes, manhole furnishings and any other materials used; also "lateral" pipes, bends and other facilities used in making connection with aerial cable and house cable systems.

In connection with the recording of the foregoing a careful listing should be made as to the paving above all conduits, laterals, etc. In many cases it is necessary to make a subsequent investigation as to what portions of the conduit were under pavement at the time of the original installation, and as to what portions are under pavement laid subsequent to the original installation of the telephone conduit system.

The final inventory forms should be in the nature of a summarized listing of the major items of underground plant—by classifications, quantities and sizes.

One point, especially, to be borne in mind. Before any of the field work is started a map should be prepared showing the general layout of the underground system. This map, preferably, should be of a scale of two hundred feet to the inch and upon it there should be entered at least a reasonably accurate record of the company's underground conduit and cable systems. If a map larger than the scale previously suggested—two hundred feet to the inch—is used, it may be divided into sections—each section bearing an identification record number. All streets and alleys should, of course, be shown on the map—and especial care should be exercised to see that the map has been checked to date. Even in preparing these preliminary maps it is well to observe the precaution of having each map, or data sheet, "initialed" by the party, or parties, responsible for the information shown thereon.

Manholes

Taking up the detail of the inventory of the underground conduit system—we will first consider the inventory of the manholes. Each manhole should be given a number—this number to appear both on the map and on the data sheet. At this juncture it may be well to call attention to the fact that the function and nature of "data sheet," above referred to, has not been very clearly explained. In the next installment the writer will present a series of illus-

trations of data sheets—comprehensive enough to include practically all classifications of manholes. These illustrations are not presented in this issue due to the fact that, some of them, involve new ideas as to the recording of underground plant—and the writer wishes to make a practical "test" in the field of the forms in question before presenting them for your consideration.

Each manhole should be treated separately and inventoried in detail. The location should be indicated on the data sheet—and of course on the map. Specific information should be recorded as to (at least approximate) distances from curbs, sidewalks, buildings, etc. A detailed diagram, or floor plan, should (in most cases) be included on the data sheet and all pertinent facts noted. One method that has been suggested for facilitating, and expediting, the work of drawing these diagrams is to make use of templets cut from cardboard, or celluloid. These templets are so proportioned as to represent the standard shapes of manholes.

Among other data to be recorded on the field sheet is the following; the inside length and width. The height, should also be given, and this latter dimension should be so subdivided as to show distance from the floor to the bottom of the entering ducts; the distance from the bottom to the top of the ducts; the distance from the top of the ducts to the roof of the manhole and the distance from the roof of the manhole to the street level.

The importance of showing the distance from the manhole roof to the street level cannot be exaggerated. As an illustration—some years ago the writer had occasion to make an inventory of the manhole system in Los Angeles, California. In a certain section of one of the outlying suburbs several streets had been filled in to a depth of about twenty feet—after the subway system had been installed. Obviously, it was necessary to build an elongated "neck" or "throat" on each manhole—at an appreciable cost. If the inventory recorder had confined himself to the manhole dimensions and had overlooked data as to this subsequent special construction—a large proportion of the residual value in the conduit system in question would have been overlooked. Another dimension to be noted is the horizontal distance from the center of the manhole to the face of all ducts entering, or leaving, the manhole.

The size and type of the manhole "casting" should also be noted.

The top, bottom and wall construction of each manhole should be noted in detail. The following code is suggested for designating the types (materials) of construction:

Brick	Br.
Earth	Ea.
Concrete	Con.
Cinders	Cin.
Wood	Wd.
Corbelled Brick	C. Br.
Brick and Rail	R. Br.
Reinforced Concrete	R. Con.
Brick Arch	A. Br.

If the manhole is jointly owned, the names of the companies and the nature of the ownership shall be indicated.

If railroad or angle irons are used, the number and size of each should be given.

A listing should be made of all "pulling-in" irons, sumps, drains, sewer connections, cable racks, cable rack hooks, bolts, washers, shields, plugs and all other miscellaneous manhole material. These items should be identified as to size, kind and code number wherever it is possible to do so.

Main Conduit

The trench length of all main line conduit together with its cross section and type of construction shall be noted on the inventory form. Measurements should be taken from center to center of manhole covers, proper deductions to be made after consulting the manhole diagram. The route of the conduit should be indicated on the field map.

A diagram of all conduit entering or leaving a manhole should be made on the data sheet showing the set up and ducts occupied. The kind of duct should be specified such as multiple tile, single clay tile, 3" iron pipe, 3" fiber, etc. In specifying the size of the duct, inside dimensions are to be noted. The type of construction may be indicated by the use of the following symbols:

Concrete Top and Bottom	TB
Concrete Top	T
Complete Encasement	CE
Plank	P
Concrete Channel	CC
Earth	E

In listing the number of ducts and kind of construction, particular care should be exercised to give the correct set up or formation. For example a nine duct cross section may be made up of one nine duct multiple tile, a six and three duct multiple tile or three, three duct multiple tiles. It must be borne in mind that this distinction is to be noted without exception in all cases.

A record should be made of the general character of the soil in which the conduit is laid.

Subsidiary Conduit

The trench length of all subsidiary conduit together with its cross section and type of construction shall be noted on the inventory form. The measurements shall be taken from the entrance of the ducts into the manhole to the point of connection with the bend. The general direction of the lateral or subsidiary conduit shall be shown on both the field map and inventory form. A diagram should be made showing the set up or formation of the ducts together with the indication of ducts occupied. The ducts and type of construction shall be specified as outlined in Conduit-Main. In specifying the size of the duct, inside dimensions are to be used.

The inventory of this class of plant shall include all riser pipes, riser pipe caps, pipe hooks, pipe straps, reducer pipes, pipe couplings, pipe plugs, pipe bends and any and all other items of material which are found to be part of the subsidiary conduit system.

The number, kind, type, size and quantity of all such items as are inventoried should be indicated. Particular care is necessary to see that galvanized hardware is listed separately from the black iron.

Wherever it is possible to ascertain the existence of conduit castings, or concrete bases on bonds, these items should be listed and noted. In the case of castings, the type should be specified. The construction specifications used by the company may be used as a guide in determining the probable kind and type of material used, where such use is evident, but owing to location is not visible.

Peculiar, or extraordinary types, or methods of construction should be noted and if necessary, adequate sketches or diagrams shall be prepared.

Whenever subsidiary conduit is jointly owned, the owners and the extent of their respective ownerships should be indicated on the data form. This also applies to main line conduit.

Pavement

The pavement existing over manholes and main and subsidiary conduit should be noted in all cases. If the conduit, or manhole, under investigation should happen to be located under more than one kind of pavement, the amount and kind of each pavement should be specified. The amount to be indicated in lineal feet, the kind to be expressed in accordance with the following code:

Earth .....E
Macadam .....M
Bitulithic .....Bi
Brick .....Br
Granite Block .....G
Brick on Concrete.....B/C
Granite Block on Concrete.....G/C
Asphalt .....A
Wood Block .....W
Cobble Stone .....CS
Concrete .....Con.
Lawn L

Any paving not conforming to the above listing should be classified and if necessary, described.

If the existing pavements show evidence of having been disturbed in the placing of the conduit and manholes, a record of the amount and kind of pavement so disturbed shall be kept. If the conduit and manholes were installed prior to the date of placement of the present paving, inquiry should be made and a record of the amount and kind of pavement that was actually disturbed at the time of the conduit installation shall be made.

Underground Cable

The inventory of the cable portion of the underground plant is even more difficult than the inventory of the conduit system. Every precaution suggested, in the opening paragraphs of this instalment, should be observed. Every telephone man who has had occasion to climb down into a manhole in the congested portion of the city will realize the importance of the thought suggested in the last sentence. Unless one had had some previous experience in the work of recording underground cable data he is apt to become confused and "make a mess" of things in general. It is difficult to tell where the cables come from; where they go to; what size they are—to say nothing of the difficulties presented in connection with the problem of examining the present condition of the cable plant.

The inventory of the underground cable plant should include underground cables, cable boxes and fittings, loading coils and other materials used in the work of installing such cables. This inventory should also include such items as subsidiary cables through laterals to pole or building terminals; the subsidiary cables to the interior or city blocks for connection with interior block wires; and the subsidiary cables entering vertically (as house cables) into buildings for connection there with inside wires.

House cables are considered to be vertical extensions of underground cables or plants similar thereto. They do not include the inside wires extending from terminal boxes of house cables to subscribers' stations, nor the cables for subscribers' private branch exchange switchboards which are included in Station installations.

The final inventory should form a summarized listing of the major items by classification, quantity and size.

Before any field work is attempted, suitable maps should have been provided as in the case of the conduit. These maps may usually be obtained, in some convenient scale, and in most cases will be up to date. As much information as is available from the records should be indicated on these field maps. If necessary, these maps may be divided into several plates or sections for convenience in handling in the field. Each such plate, or section, should be numbered and reference made thereto on the data forms.

Cable—In Main Ducts

Each cable should be given a number, and this number should appear both on the map and on the data form. The numbers should be assigned, preferably, at the main frame. Each main cable number should be borne by all branch or distributing cables which branch therefrom. The size (No. of pairs) gauge and type should be specified. The type may be indicated by code, as will be shown in the next issue. Composite cables, in each case, shall be particularly described, and if possible, the date of installation shall be ascertained and indicated on the data sheet.

The size, gauge and type of each cable should be carefully checked with the existing records. It may not be possible in all cases to determine the type from actual field inspection. If this is the case, company employees, familiar with the plant, should be called upon for advice and information. The records of cable disbursements at the particular exchange under inventory will disclose, in many cases, the desired information. In any event, it is most essential that the type be specified.

As previously suggested, the close relation between underground conduit and cable, makes it advisable to inventory these two items at same time—in order to acquire a maximum of efficiency, speed and accuracy.

In recording the measurements of cables in ducts, measurements from the middle of the splice in one manhole to the middle of the splice in the adjacent manhole is desired. The length of duct run as previously determined will represent the length of cables in ducts. The measurements of the cables from the face of the ducts, in the manhole, to the middle of splice should therefore be taken to complete the desired information.

On the diagram of the manhole, the location of all cables together with location of all splices shall be shown, and the duct assignment of each cable indicated. Measurements mentioned in the preceding paragraph relative to "face of the duct to middle of splice" should be indicated clearly.

If cables are bonded, or grounded, or both, this fact should be recorded, indicating on the field form the kind —and at the same time specifying the number of cables bonded. If bond or "fish" wires are occupying ducts, give the amount, size and gauge of such wires and indicate the ducts containing them.

If any cable is jointly owned it should be so indicated, preferably by a code identifying the owners and the extent of ownership.

If foreign cables are located in the ducts, this fact shall be noted together with their duct assignment. Measurements on such cables are not required.

A detailed sketch and listing of items should be made for cable, and incidental, items—from the office manhole, or vault, to the main distributing frame. All items should be properly described and the diagram, or sketch, should show the cable routing, existing construction and all necessary measurements. Particular care should be used in specifying the pot-heads, splices, types and sizes of cables.

Cable—In Subsidiary Ducts

Each subsidiary cable shall be given the same number as the main cable of which it is a part. This number should appear on the data form and field map.

The size, gauge and type of each cable should be carefully checked with the existing records and recorded on the field sheets. The type should be indicated in code. The measurement to be recorded should be that from the center of the splice, in the manhole, to the center of the splice on the pole. If the cable terminates in a hand pot-head, the measurement shall be taken to the center of the sleeve of such pot-head.

Cable straps, cleats, and moulding used on lateral or subsidiary cables should be tabulated, together with the kind, type, size and quantity thereof.

Pole seats, balconies, ladders and similar appurtenances used in conjunction with underground cables should be listed and properly classified. The kind, number, size and code or manufacturer's number should also be carefully noted. If a diagram or sketch is necessary, in order to

(Concluded on Page 44)

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WHAT IS YOUR TROUBLE?
A Department of Questions and Answers

Question: Will it be possible in time to eliminate the telephones now in use by wired system by radio through aerial signals?

Answer: One of the principal reasons why this cannot take place at the present time is the difficulty in sending out telephone messages which would be secret in their reception. A device has not as yet been placed on the market which would make the sending out of messages in this manner a secret process. It might be stated in this connection, however, that considerable progress has been made in the sending out of secret messages for telegraph purposes. Apparatus has been designed not only for transmitting, but also receiving telegraph messages at high speed.

This system operates on a code plan and means is provided for rapidly changing the system of transmitting and receiving the code.

It will be clear that it would be extremely difficult to adopt this system, however, for sending out telephone voice currents. It is claimed, however, that certain wave filters have been designed which will transmit carrier currents with modulated voice current thereon that can be sent out at a specified frequency and only be received by transmitting stations that are equipped with suitable wave filters for receiving this particular type of wave frequency. However, this would be only a start on the problems involved in making the universal transmission of telephone voice currents similar to the multiple system of present wire telephony.

It would also be necessary to equip the receiving sets with relays so designed that they would respond only to a prearranged signal or system of signals, so as to notify the party called that the message was about to be delivered by radio. All receiving sets necessarily would have to be equipped with transmission sets in order that response could be made to the message received. The operation of a transmission set has not been brought down to that simplicity which is found in the present receiving set, and in order to make such a set suitable for universal use with the ordinary unskilled subscriber considerable changes would have to be made in the present complicated method of transmitting voice frequency. While it is somewhat difficult to conceive of a transmission set of this simple design at this time a few years ago it was just as difficult to picture the simple receiving set which is now used and which is capable of receiving signals over a thousand miles.

Question: There seems to be considerable argument as to the necessity of using a highly efficient telephone which is located in series with a storage battery such as is found in an ordinary amplifying set. Advise whether an ordinary telephone set is suitable for the purpose.

Answer: In a crystal receiving set there can be no question as to the necessity of employing the most efficient type of head receiving telephone. At best this will give only ordinary results, so that it will be evident that an inefficient telephone would make the signals very delicate and hard of reception. It is, of course, to be understood that a receiver consisting of inexpensive parts will not stand the wear and tear as satisfactorily as a set which is made of good material and built for rough treatment. In an amplifying set the best type of telephone should also be used. This is especially true in the summer months, due to the effect of the atmosphere upon wireless wave reception. While it is possible the more expensive type of receiver may give a greater range than is required during the winter months, it will be more than necessary to have such an efficient telephone during the summer months. In general it may be said that the purchase of a high grade telephone receiver is absolutely necessary for good radio receptions under any condition.

Question: We are considering the installation of a transmission radio system on the top of our telephone building and would appreciate it if you would advise us of the various sources of energy when using power tubes in the radio transmission system.

Answer: The vacuum power tube must have a low voltage for lighting the filament and a high voltage for furnishing the proper amount of energy to the plate electrode. The necessary voltage to operate a satisfactory plate circuit may be obtained as follows:

No. 1. A direct current generator high in voltage.

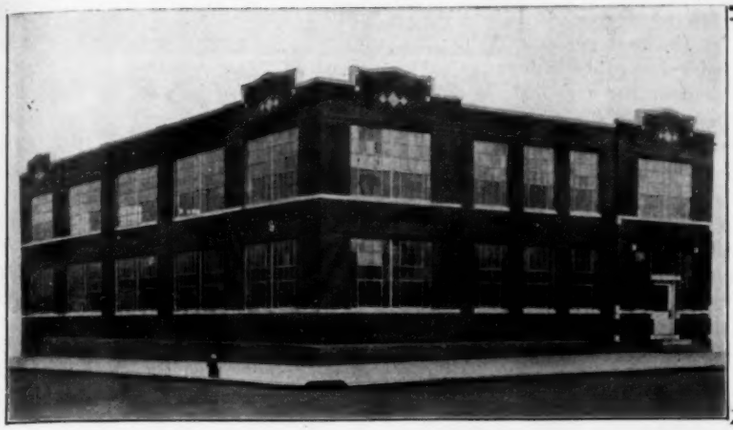
No. 2. A self-rectification circuit in which the alternating current energy is applied at the plate.

No. 3. Rectifier valves of two electrodes applied to the source of alternating current. If a source of 110 or 220 volts of direct current is available it would be necessary to install a direct current generator of higher voltage. A motor of such a set should be supplied with slip rings so as to provide an alternating source of supply for the filament by using a step-down transformer. The rating of power tubes which are used will determine the high voltage of the D. C. generator. When using an A. C. source of supply a transformer and two rectifier valves arranged in the proper circuit can be used to rectify the halves of the A. C. cycle. It is convenient to have a high voltage secondary of the transformer furnished the plate circuit and by means of two other additional secondaries provide the step-down voltage to light the filaments of power tubes and the rectifier valves. It is, of course, essential to have in such a circuit to smooth out the ripple in the plate current the suitable reactance in condenser.

From the second source of supply described above power tubes are connected in a circuit in which the alternating current voltage is applied to the plate circuit. In such a circuit tubes act both as rectifiers and oscillators, using in this manner both halves of the alternating current circuit. This circuit is known as the self-rectification method. A method of this kind, however, is only suitable for telegraph purposes in wireless systems. It has been found to be absolutely necessary that a direct current source of energy must be obtained either through a direct current generator or a rectifying system for wireless telephony purposes.

Question: In using wired wireless either over telephone or electric light circuits, should the receiving set be fused with the circuit connected to the aerial?

Answer: Ordinary precautions require that such a circuit be fused. If for no other reason than to prevent 110 volts from destroying the receiving set. A one-half ampere fuse is entirely satisfactory for this purpose.



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(Continued from Page 40)

give proper identification, this should be drawn and reference made thereto in the field notes.

All terminals forming a part of the underground cable plant should be inventoried. The type, size and code number or manufacturer's name should be indicated on the form. If the make or identity of the terminal is not known, sufficient details should be taken in order to properly classify it.

Each terminal should be assigned a number which is to appear both on the field map and data form. For the more frequent type of terminals a code may be employed to designate them on the maps. The number assigned to the terminal should be the one indicated on the terminal, or in the absence of this, the number appearing in the cords should be used.

The number of protector mountings should be recorded together with the type and code number. The number **per strip** should always be specified.

Miscellaneous terminal equipment such as fanning strips, fuses, protector blocks, micas, terminal strips, etc., should be recorded. Show the quantity, kind, size and code number of each item listed.

"Bridle" wires, rings and incident items constitute a part of the aerial wire plant, but in order to eliminate the possibility of their omission from the inventory, they should be taken and listed as described under Aerial Cable by the men responsible for the aerial cable inventory, **unless** no cable extends from the terminal, in which case these items should be taken by the men responsible for the underground cable data.

All grounds and bonds forming a part of the underground cable plant should be noted and listed. The type, kind and number of each should be indicated. Where wire is used for these purposes the kind, gauge, and size should be specified.

All pot-heads assignable to underground cable should be noted and recorded on the data form, stating the size in pairs, the gauge of the wire and the mode of construction; i. e., whether hand made or patent (sometimes called machine made).

Wire used for cross connecting purposes, should be inventoried, showing the kind, number and gauge of each together with the average length per jumper.

Any particular or special type of construction or special items of material of which no mention has been heretofore made should be included. Diagrams and sketches should be made if necessary, indicating thereon measurements and locations with cross references to both the data form and field map.

All construction splices forming a part of the subsidiary underground cable plant should be included, giving size (in pairs), number and gauge of wire. State whether straight, tap, or multiple, in the case of tap splices specify both sizes of cables, in the event of multiple splices specify the largest sized cable only. Splices to the main cables should not be included as subsidiary cable splices. Wherever cables enter buildings or structures, particular note should be made thereof, and the supervisor's attention called thereto, in order that such property may be inventoried by the men responsible for Building and House Cables. A "marker" should be used to designate the point to which the last measurement was made by the underground field men.

The writer realizes, fully, that this installment includes a large amount of detail—involving rather "dry" reading. However, he feels that this subject of proper methods of inventorying the underground portion of a telephone company's plant is so important that its treatment, in detail, will afford a vast amount of usable information to the reader.

In the August installment the field forms—referred to in an earlier portion of this installment—will be presented and the whole subject of the inventory of the underground plant summed up, with a brief reference to methods for recording house, and interior block, cable data.

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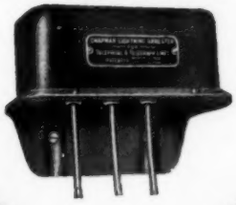

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April's Phone Earnings Show Good Increase

Washington, D. C.—Reports of seventy-one telephone companies in the United States to the interstate commerce commission for the month of April show operating revenues of $47,842,643, an increase of $2,595,806 compared with the corresponding month last year; balance, after expenses, of $14,259,484, an increase of $953,665, and an operating income of $10,454,418, an increase of $398,562.

From January 1, the reports show operating revenues of $188,470,166, an increase of $13,998,340 compared with the corresponding period last year; balance, after expenses, of $55,693,531, an increase of $8,455,100, and an operating income of $40,435,543, an increase of $5,414,077.

July 20-22 Set for Western Pennsylvania Meeting

Conneaut Lake, Pa.—John Z. Miller, chairman of the program committee of the western branch of the Pennsylvania State Telephone and Traffic Association promises a rousing meeting of the organization on July 20-22, at Conneaut Lake, Pa. W. S. Vivian will conduct the operators' school, and a wireless demonstration will be given by W. S. Paca of Oil City. Convention sessions in the morning and typical summer resort pastimes in the afternoon and evening will crowd the delegates' time.

Moore, Federal Globe-Trotter, Again Back at Buffalo

Buffalo, N. Y.—B. L. Moore, Vice President of the Federal Telephone and Telegraph Co., has returned to Buffalo after a highly profitable 14 months' sojourn in foreign countries. Mr. Moore expresses keen satisfaction with the international distribution that has been gained by Federal telephone and radio equipment.

Arvin, Cal.—The Arvin Mutual Telephone Co. has been incorporated here with capital stock of $25,000.

Illinois Meet at Peoria, September 19-21

Peoria, Ill.—Jefferson Hotel at Peoria has been picked as the place for the Illinois Telephone Association's annual convention. A three-day session, beginning September 19th, will be held. The annual traffic conference will be held at the same time. Hotel reservations should be placed direct with the Jefferson or through Michael J. Finn, manager of the Peoria Association of Commerce convention department. Jay G. Mitchell, Sec.-Treas. of the Illinois association plans to release details of an interesting program in the near future.

Ten Years of Canadian Phone Progress Reviewed

Vancouver, B. C.—Telephone Talk, the house organ of the British Columbia Telephone Co., devoted its June issue to a review of the past ten years' progress of the organization. Pictures of the company's present exchanges are shown, which with the data concerning the company's status, make the issue especially interesting as an indication of prevailing conditions in British Columbian telephony.

Harrisburg, Pa.—Central Pennsylvania Bell veterans have formed a chapter of the Telephone Pioneers of America. The local chapter was chartered with 80 members.

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